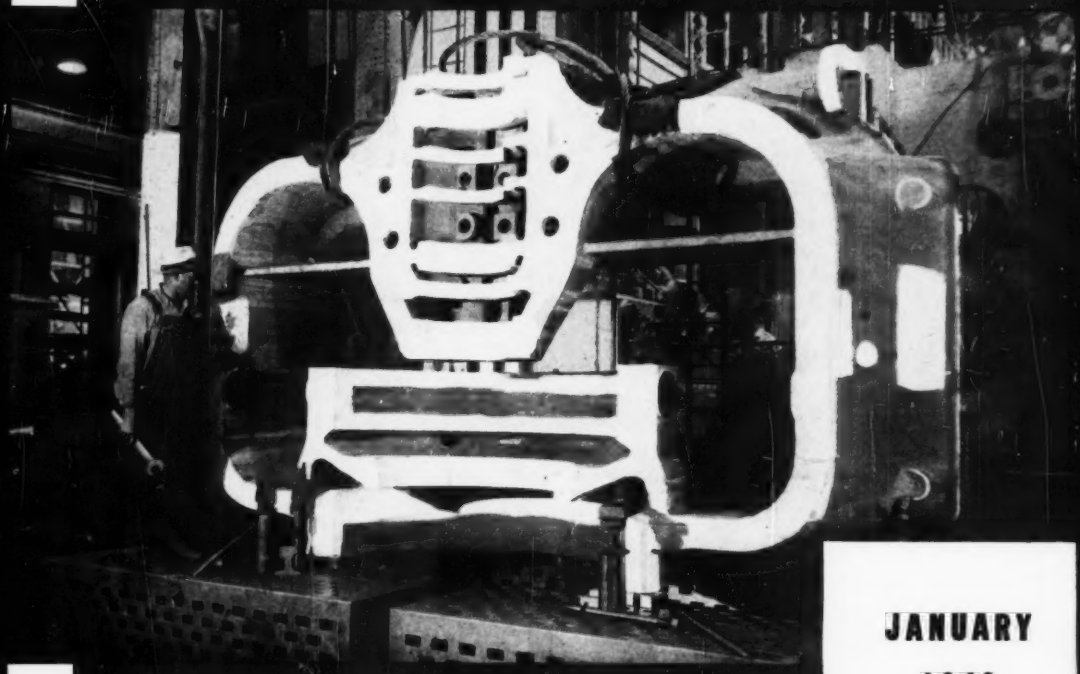
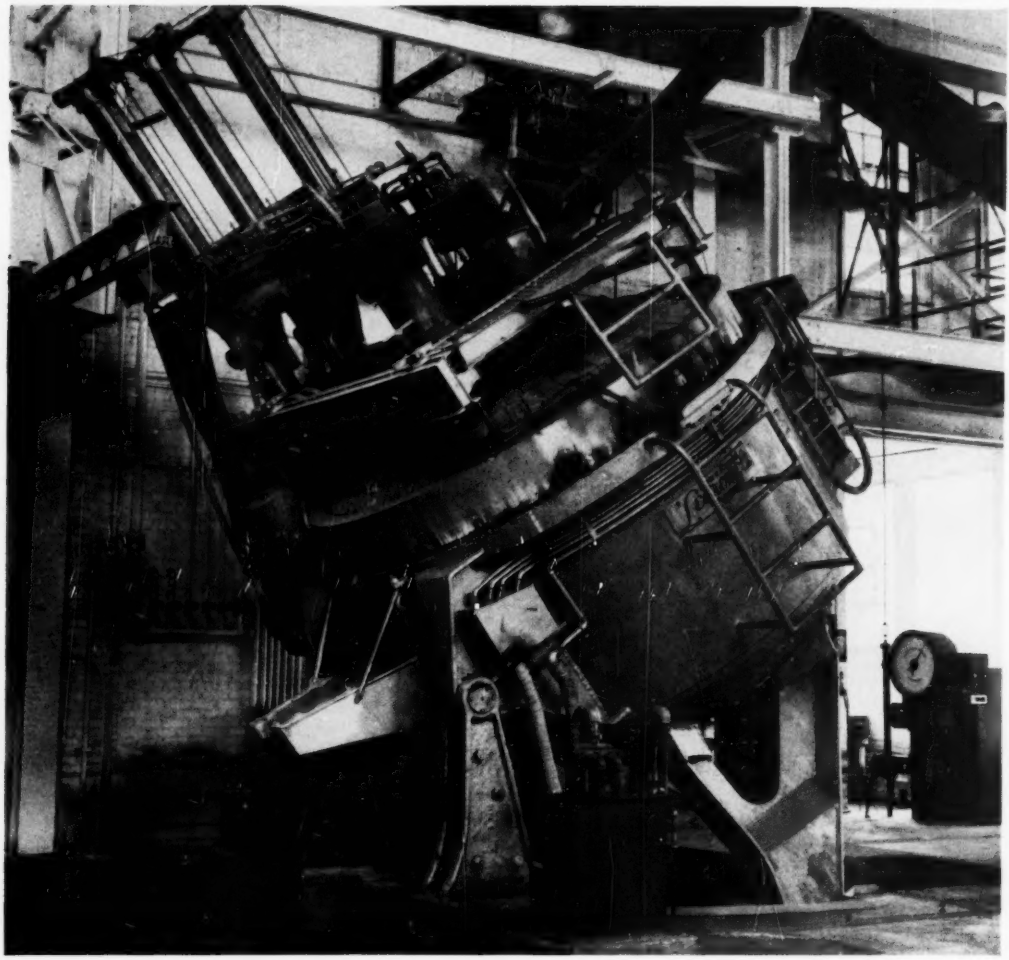


JANUARY

1949



THIS SIZE PT Moore Rapid Lectromelt Furnace, located in a midwestern foundry, is pictured here in full tilt position which provides unusual ease in pouring. The Lectromelt PT has an hourly rating of three tons and melts up to six tons in a single heat. Its usual single turn foundry output is 24 to 28 tons. The PT is a topcharging furnace with counterbalanced electrode arm controls.

Lectromelt furnaces of the topcharging type are built in capacities ranging from 100 tons down to 250 pounds. Full details on any size will be provided by

PITTSBURGH LECTROMELT FURNACE CORPORATION
PITTSBURGH 30, PENNSYLVANIA

Lectromelt

are manufactured in: CANADA, Lectromelt Furnaces of Canada Ltd., Toronto 2; ENGLAND, SWEDEN, AUSTRALIA, Birlec, Ltd., Birmingham, England; FRANCE, Stein et Roubaix, Paris; BELGIUM, S. A. Belge, Stein et Roubaix, Bressoux-Liege; SPAIN, General Electrica Espanola, Bilbao; ITALY, Forni Stein, Genoa.

SIGNS of the trend...

Here's an 18-second summary on why most foundries use Crown Hill Seacoal Facing for venting molds.

● The high volatile content (see Bureau of Mines figures) of Crown Hill means quick flash. Since the fusion point of the small ash residue is 2980° F., molten iron cannot fuse it, and low sulphur content eliminates hard spots. In short, peeling is easy and cleaning costs *come down*. Try Crown Hill, choice of most foundrymen.

FIGURES FROM BUREAU OF MINES
DEPT. OF INTERIOR OF THE U.

PROXIMATE ANALYSIS

Volatile Matter (V.C.M.)	38.6
Fixed Carbon	57.4
Ash	3.7
	100.0

ULTIMATE ANALYSIS

Hydrogen	5.2
Carbon	82.7
Nitrogen	1.2
Oxygen	6.9
Sulphur	.5
Ash	3.7
	100.2

Fusion Point of Ash 2980°F

THE FEDERAL FOUNDRY SUPPLY COMPANY

Seacoal Plant
CROWN HILL, W. VA. • CHICAGO • DETROIT • MILWAUKEE • RICHMOND, VA.
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Bourbon Furnace, Bath County, Kentucky, in 1791. Men with guns and a blockhouse were needed to protect ore diggers against warlike Indians.

INTERLUDE IN IRON MAKING . . . 1791

Dangerous and discouraging was the castings business in 1791. Indians sniping from behind rocks and trees . . . bog iron containing phosphorus and other weakening elements—such were the troubles which make those of modern foundries seem trivial. Yet hostile savages and impure ores didn't stop the supply of early castings.

Indians nowadays are no foundry problem, but it is still vital to reduce impurities in cast iron – a job made simpler with PURITE.

In the forehearth, or teapot ladle, PURITE reduces sulfur, permitting close control over refining. In the cupola, PURITE improves combustion, expels occluded gases, reduces oxidation, prevents sulfur pick-up, and washes out non-metallic impurities. The resulting better mixture of cupola iron, coupled with the refining, insures a clean, quiet pouring metal of uniform analysis . . . makes for lower losses, increased strength and improved machinability in the finished casting.

Write for more information about PURITE—what it is and how to use it. Mathieson Chemical Corporation, 60 East 42nd Street, New York 17, N. Y.

Mathieson
PURITE

Purite (Fused Soda Ash) . . . Liquid Chlorine
Caustic Soda . . . Soda Ash . . . Bicarbonate of Soda . . . Ammonia, Anhydrous & Aqua
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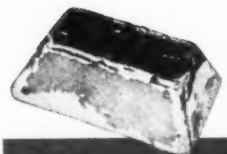

PURITE is commercially pure soda ash containing over 98% sodium carbonate, fused and cast into convenient 2-lb. pigs. Its desulfurizing and refining action are traceable to the chemistry of soda ash.

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JANUARY, 1949

CONTENTS

VOLUME XV, NUMBER 1

American Foundryman

January, 1949

Official publication of American Foundrymen's Society

Production Control — Key to Lower Costs, Better Castings: F. C. Riecks

Announce Tentative Program for 1949 Annual Foundry Congress

Announce 1949 Nominations for Officers and Directors of the American Foundrymen's Society

Eighteen Days Behind the "Iron Curtain": Lester B. Knight

Historic Highlights of the Metal Castings Industry

Outline Programs for Two Regional Meets

Quality Control Review — Summarize Procedures for Steel Foundrymen: John W. Juppenlatz

Foundry Career Opportunities: John B. Caine

Uses Standard Permanent Mold Equipment

Modern Foundry Methods — Molding a One Piece Bronze Turbine Runner Model Casting: H. W. Bennett

Belgian Research Advances Nodular Graphite Theory: Albert De Sy

The Round Table

FEF Outlines Student Program

MIT is Host to New England Foundry Conference

Who's Who

Letters to the Editor

New A.F.S. Members

Foundry Personalities

Chapter Meetings

A.F.S. Chapter Officers and Directors

Chapter Activities

New Foundry Products

Foundry Literature

Foundry Firm Facts

Advertisers' Index

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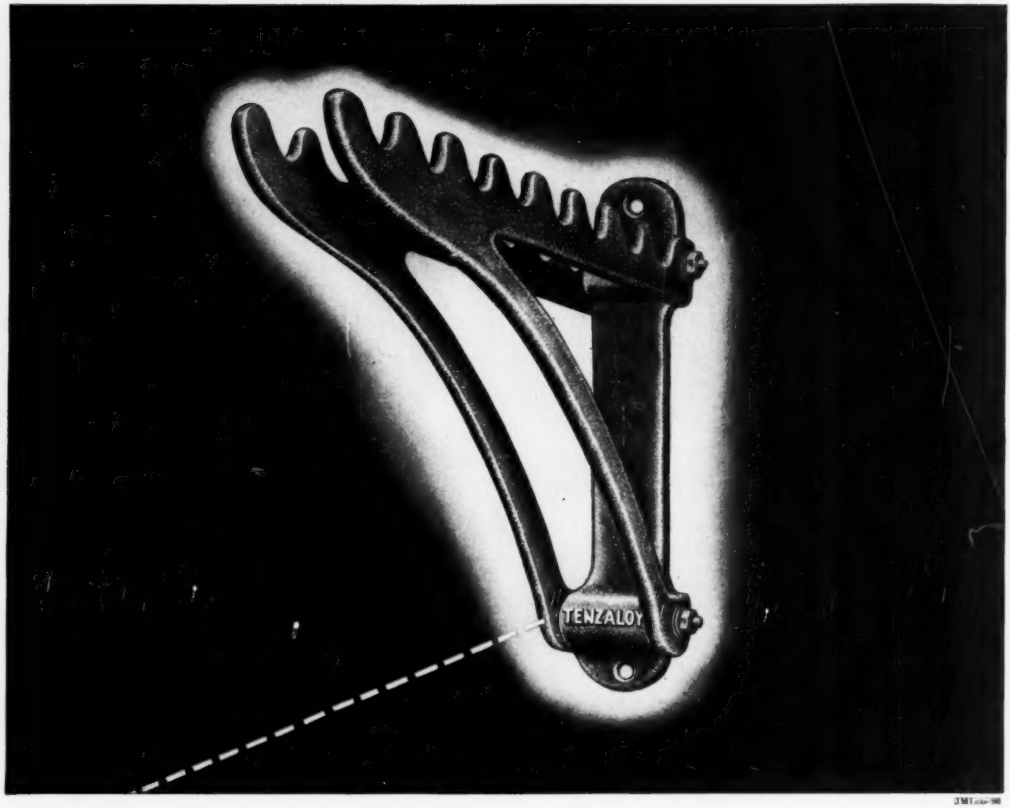
The American Foundrymen's Society is not responsible for statements or opinions advanced by authors of papers printed in its publication.

This Month's Cover

Machining an exhaust end casting of a steam turbine casing for a turbo-generator in one of the five machine shops of the Newport News Shipbuilding and Dry Dock Co., Newport News, Va. Produced in the Newport News iron foundry, this 25-ton casting is one of many types and sizes produced up to a weight of 50 tons. This foundry is one of the early users of the cement molding process for heavy castings described in detail in *"Portland Cement as a Binder for Foundry Molding Sand,"* TRANSACTIONS OF A.F.A., vol. 45, 1937.

Published monthly by the American Foundrymen's Society, Inc., 222 W. Adams St., Chicago 6. Subscription price in United States, Canada and Mexico, $3.00 per year; foreign, $6.00 per year. Single copies, 50c. Entered as second class matter July 22, 1938, under Act of March 3, 1879, at the post office, Chicago, Illinois.



For High Strength without Heat Treatment!

This aluminum casting is a tool rack for shovels, hoes, rakes and other heavy garden equipment. The Max Manufacturing Company of San Jose, California, chose Tenzaloy, Federated's new aluminum casting alloy, for the fabrication of the product "because of its great strength as cast, without the necessity of heat treatment." Tenzaloy tensile strengths average 29,000 psi as cast, and 35,000 psi with 10-14 days aging at room temperature.

This manufacturer also states that Tenzaloy is his choice because "standard foundry procedures can be followed in its use, and the end product is a nice clean casting with a minimum of fuss, bother and expense."

Tenzaloy also has excellent ductility, impact resistance, castability, machinability, corrosion resistance and superior polishing characteristics. Send now to Federated's Dept. SJ for literature that describes Tenzaloy more fully.

Federated produces many other non-ferrous metals and alloys, including brass, bronze, aluminum and magnesium ingot; solders; type metals; die casting metals and fabricated lead products. Sales offices in 25 cities across the nation.

Federated first in the non-ferrous field. AMD

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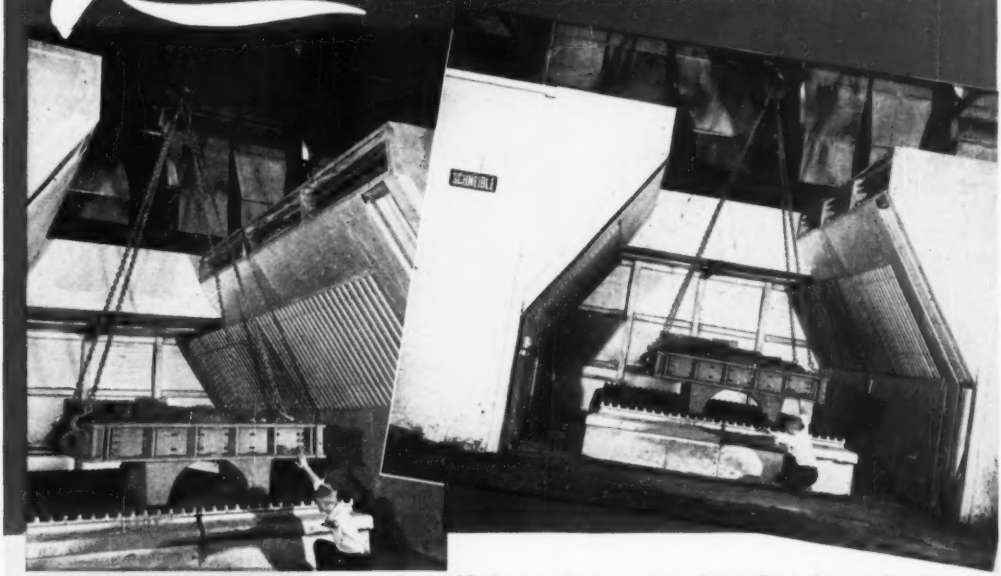
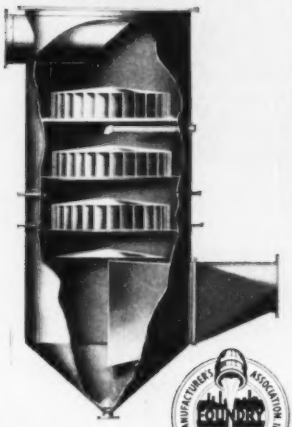
Division of American Smelting and Refining Company, 120 Broadway, New York 5, N.Y.

Giant UNI-FLO BOOTH CUTS OPERATING COSTS!



Foundry Efficiency Steps-up—Heating Costs Go Down!



Air contamination resulting from large shake-out operations is no longer a problem. The new Foundry-proved Schneible Uni-Flo Booth throws a compensating air blanket over the entire shake-out and effectively conveys dust and smoke to the Schneible Multi-Wash Dust Collector, while heavier particles are settled out into the Schneible Velocitrap and onto the shake-out conveyor belt. These two special Schneible units are built-in features of the Uni-Flo System. Complete freedom of crane operation is provided—chains do not have to be removed from the flasks. It is no longer necessary for workers to leave the job during the shake-out operation—clean, fresh outside compensating air keeps the job going at top efficiency.

The fact that this compensating air supply is taken from outside the plant offers another Schneible money-saving feature. Undesirable air flow currents are eliminated and the warm air adjacent to the shake-out operation is not pulled out of the plant. This keeps down heating costs while maintaining comfortable on-the-job temperatures.

Let our engineers show you how the Uni-Flo Hood will fit your plant at low costs. (U.S. and foreign patents applied for.) Claude B. Schneible Co., 2827 Twenty-Fifth St., Detroit 16, Michigan.

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Two models are available—the HC with capacities from 1500 to 30,000 c.f.m. or multiple units for larger capacities.

The JC—from 1000 to 30,000 c.f.m. capacity or in multiple units.

Free

Write for bulletins Nos. 410, 47 and 48 which cover the Uni-Flo and Multi-Wash systems in detail.

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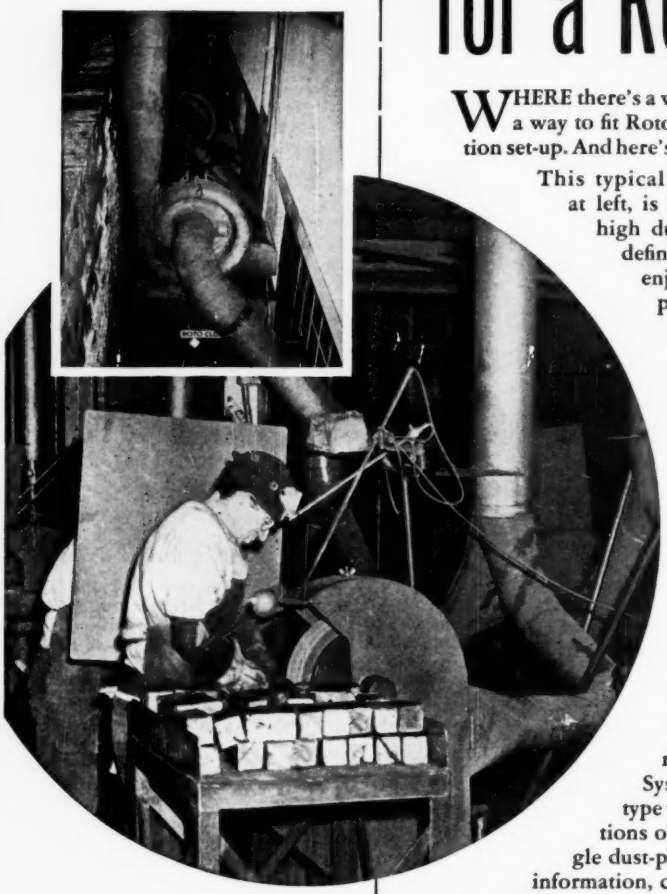

WHERE there's a will to practice dust control, there's a way to fit Roto-Clone* into your present production set-up. And here's an installation that proves the point.

This typical grinding department, pictured at left, is engaged in snagging forgings—a high dust-producing operation. Space is definitely at a premium, yet the workers enjoy the full benefits of Roto-Clone's positive dust control. Hoods and ducts are all you see. The four Type D units, shown above, which serve these grinders are installed in a light well just outside the building—out of the way but always on the job.

The Type D Roto-Clone combines the functions of exhauster and separator in a compact, self-contained unit. All operations—drawing in the dust-laden air, separation of dust, delivery of collected material to storage hopper and expelling the clean air—are performed by one moving part.

And remember—there's always room for a Type D Roto-Clone System. It may be installed as a central type with main duct and branch connections or as individual units serving a single dust-producing operation. For complete information, call your local AAF representative or write direct to—

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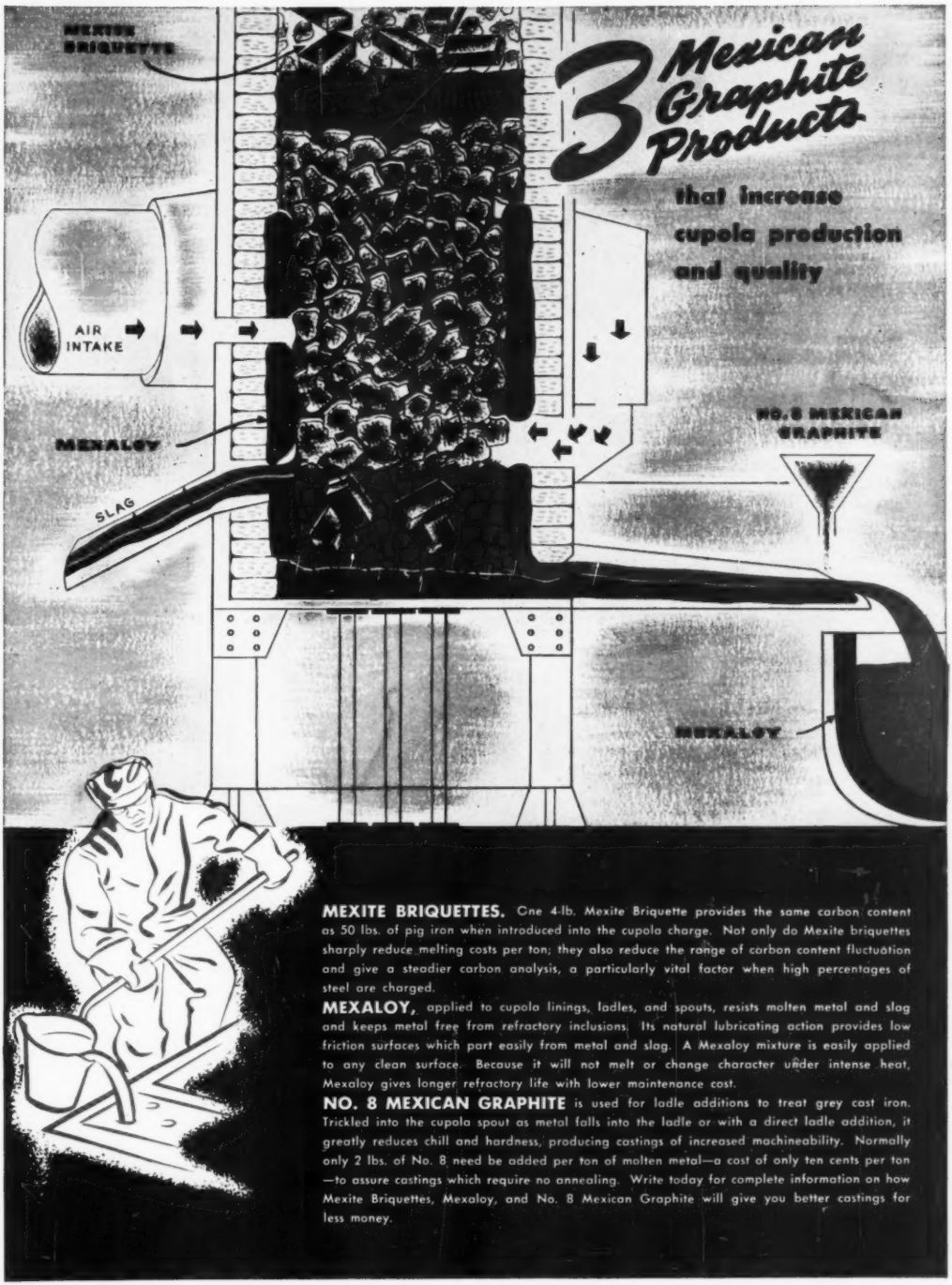

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that increase cupola production and quality

MEXITE BRIQUETTES. One 4-lb. Mexite Briquette provides the same carbon content as 50 lbs. of pig iron when introduced into the cupola charge. Not only do Mexite briquettes sharply reduce melting costs per ton; they also reduce the range of carbon content fluctuation and give a steadier carbon analysis, a particularly vital factor when high percentages of steel are charged.

MEXALOY, applied to cupola linings, ladles, and spouts, resists molten metal and slag and keeps metal free from refractory inclusions. Its natural lubricating action provides low friction surfaces which part easily from metal and slag. A Mexaloy mixture is easily applied to any clean surface. Because it will not melt or change character under intense heat, Mexaloy gives longer refractory life with lower maintenance cost.

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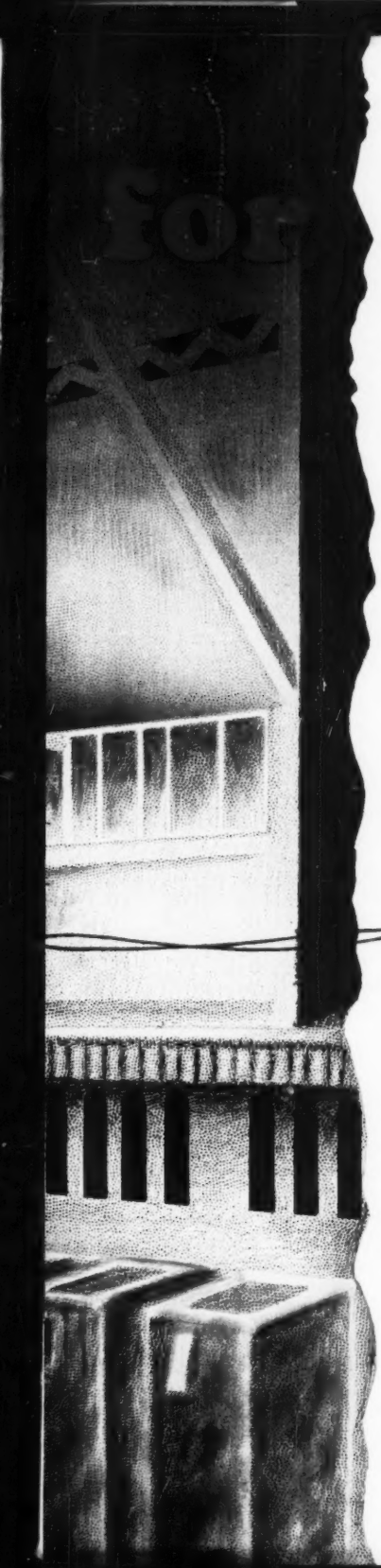

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• Just as a tailor-made suit is custom-fitted to the lines of your figure, so too are Thiem core washes and mold coatings *tailor-made* to your individual foundry requirements. Thiem technicians realize that foundry practices differ greatly — that a product which is perfectly suited to one foundry operation may not be nearly as effective in another. Because of these differences, Thiem products are literally *custom-fitted* to your way of doing things. The result is quality products that cut costs, speed operations and eliminate mixing errors.

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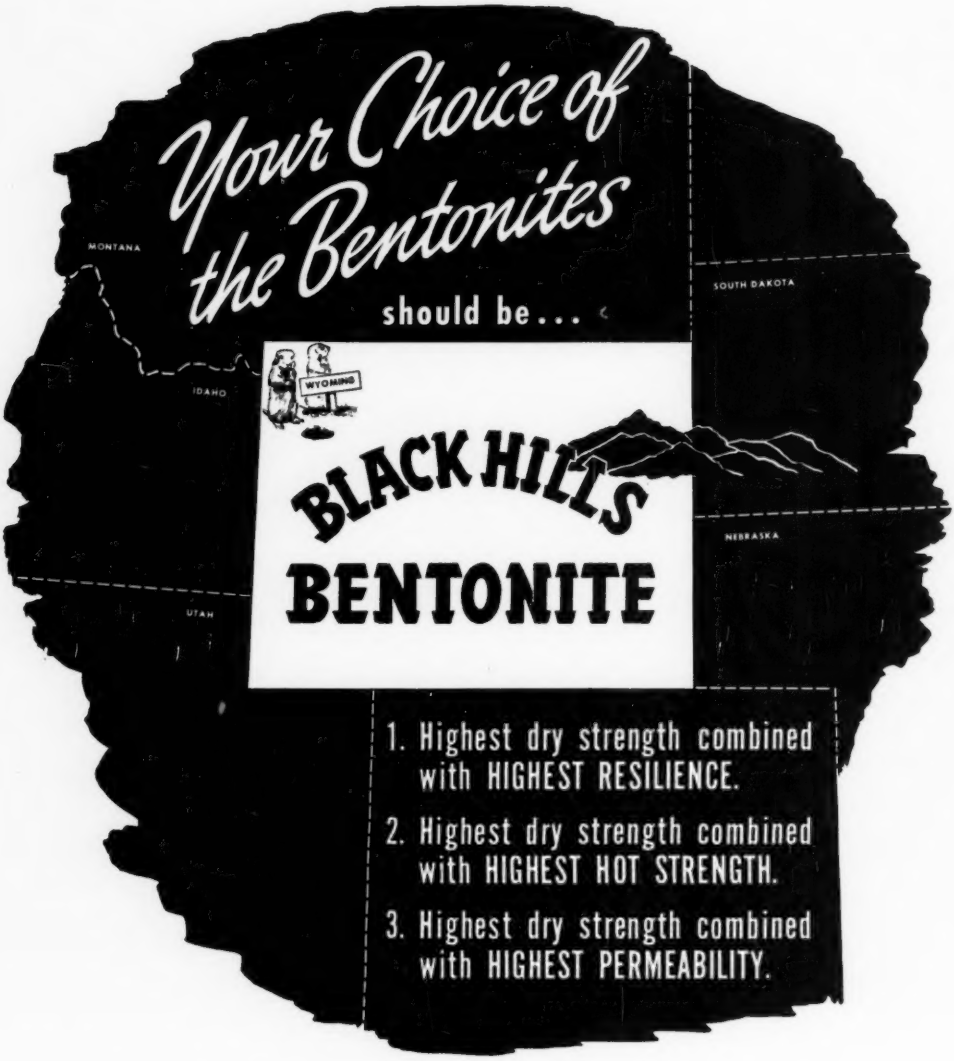

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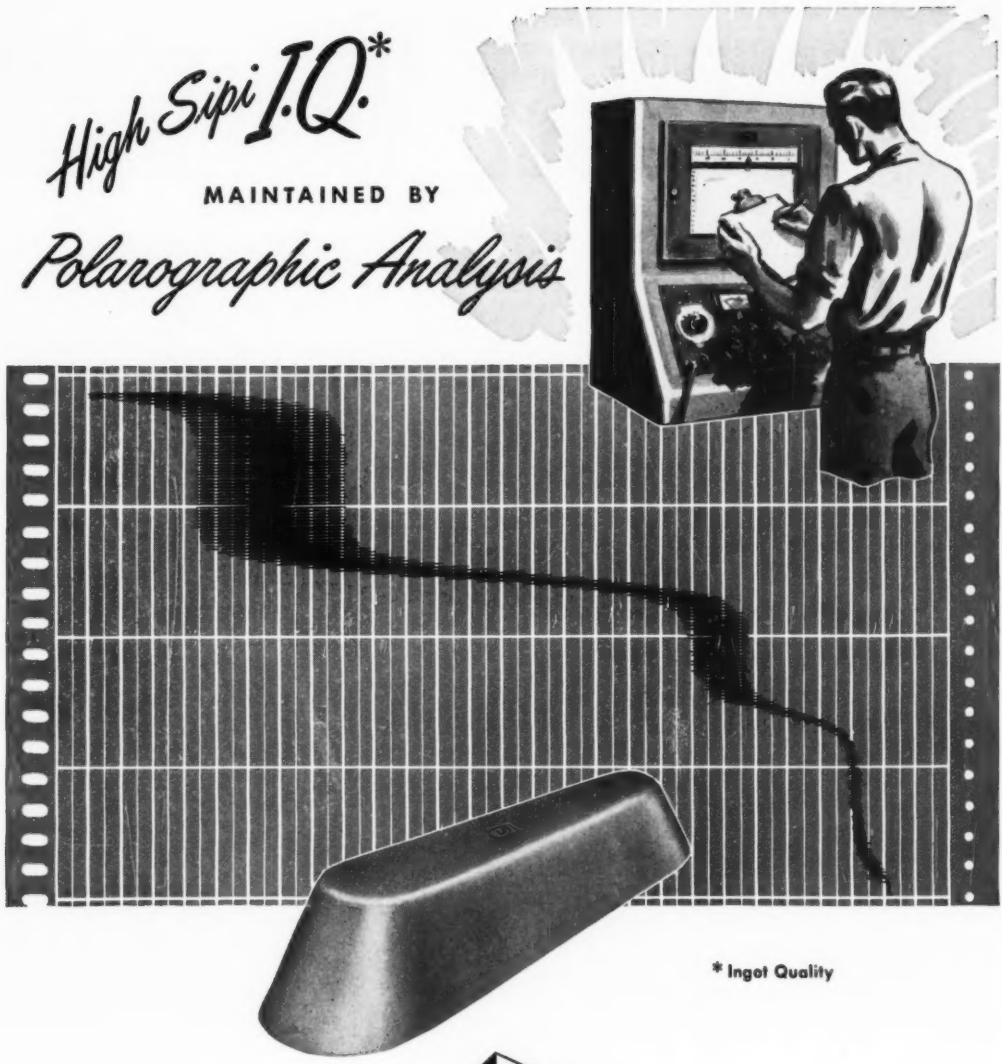

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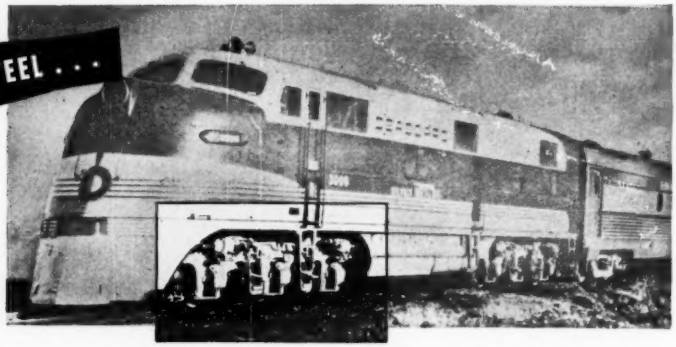

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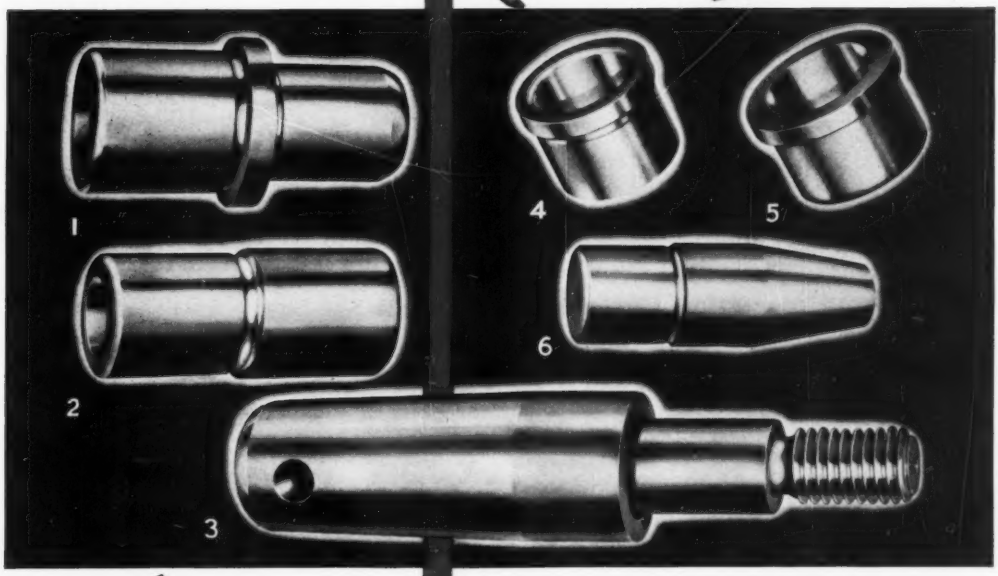

1. Shoulder Flask Pin
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3. Plate Pin
4. Round Flask Bushing
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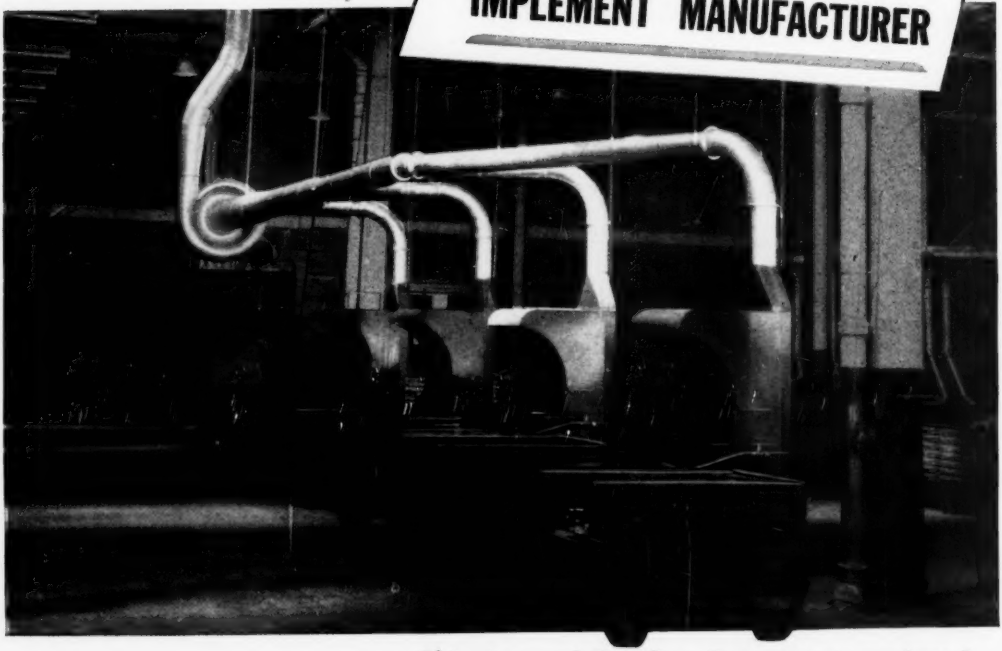
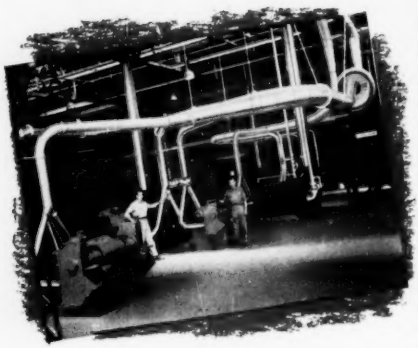
"CHIPS fall where they may?"

..but NOT IN PLANT OF NOTED IMPLEMENT MANUFACTURER





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Chipping and Grinding Departments equipped with KIRK & BLUM Dust Collecting Systems . . .

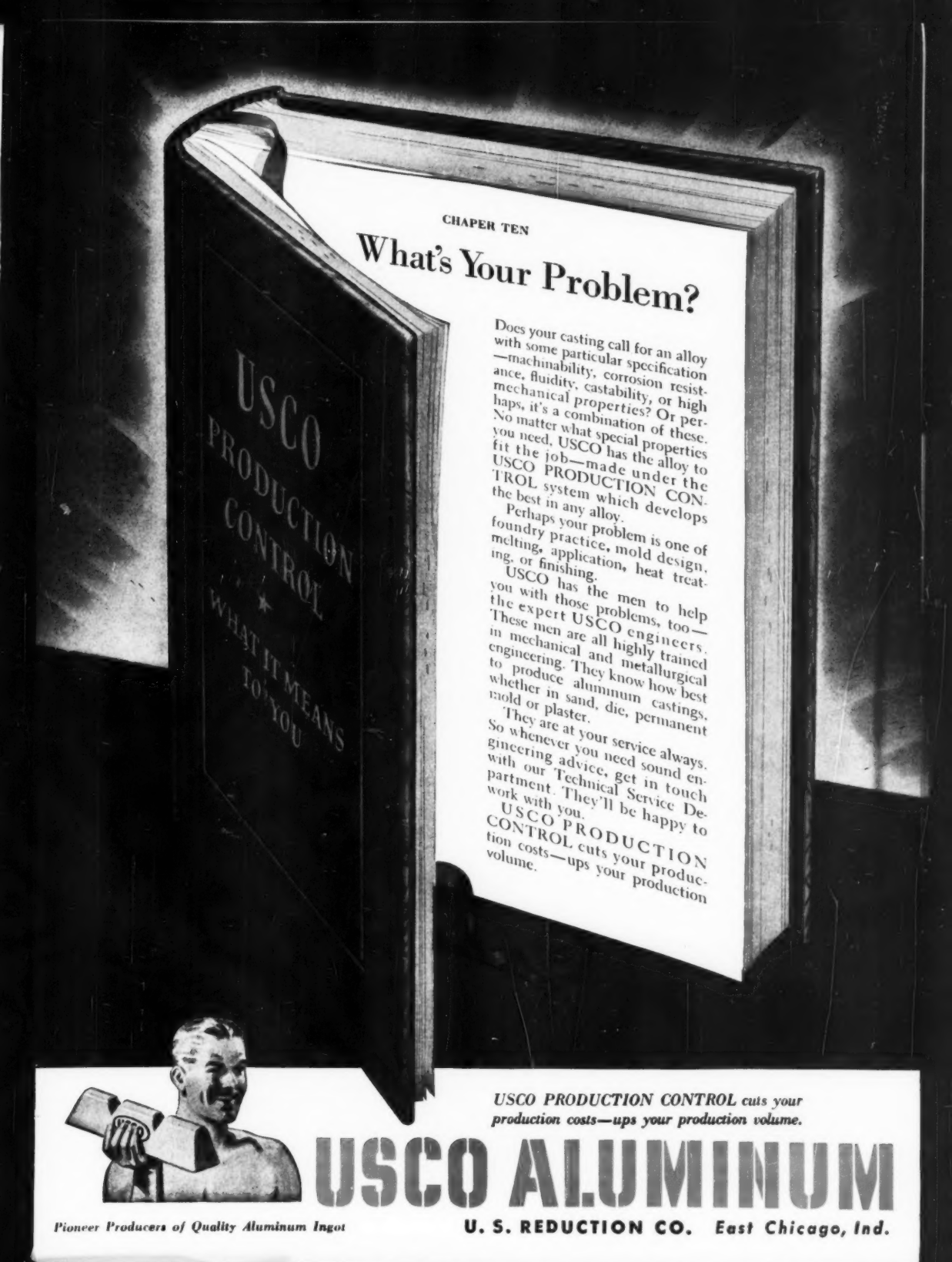
● Today's modern foundry places more and more emphasis on efficient dust collection. A newly constructed Southern foundry containing the most advanced equipment was recently placed in operation by one of the nation's largest manufacturers of farm equipment. Part of the chipping and grinding department of this foundry is illustrated here.

● This noted firm realizes that clean air means greater production, happier and healthier workers, less maintenance and replacement costs on motors and other equipment.

● Besides the systems shown here, KIRK & BLUM built and installed a variety of other systems for dust and fume removal. If you are considering building or remodeling your plant, you can profit from Kirk & Blum experience on this and hundreds of other jobs. Write for free booklet "Dust Collecting System in Metal Industries." *The Kirk & Blum Mfg. Co., 2876 Spring Grove Ave., Cincinnati 25, Ohio.*

FOR CLEAN AIR... THE INVISIBLE TOOL

KIRK AND BLUM
DUST CONTROL SYSTEMS



CHAPER TEN

What's Your Problem?

Does your casting call for an alloy with some particular specification —machinability, corrosion resistance, fluidity, castability, or high mechanical properties? Or perhaps, it's a combination of these. No matter what special properties you need, USCO has the alloy to fit the job—made under the USCO PRODUCTION CONTROL system which develops the best in any alloy.

Perhaps your problem is one of foundry practice, mold design, melting, application, heat treating, or finishing.

USCO has the men to help you with those problems, too—the expert USCO engineers. These men are all highly trained in mechanical and metallurgical engineering. They know how best to produce aluminum castings, whether in sand, die, permanent mold or plaster.

They are at your service always. So whenever you need sound engineering advice, get in touch with our Technical Service Department. They'll be happy to work with you.

USCO PRODUCTION CONTROL cuts your production costs—ups your production volume.

USCO PRODUCTION CONTROL cuts your production costs—ups your production volume.

USCO ALUMINUM

Pioneer Producers of Quality Aluminum Ingot

U. S. REDUCTION CO. *East Chicago, Ind.*

Your Answer TO PRODUCTION AT LOWER COSTS *may be in*

SIMPLE, ECONOMICAL *Modernization Measures*

A substantial improvement in production often can be achieved without costly investments in additional space, equipment or personnel. Many foundries have discovered that it is only necessary to employ improved procedures and methods with more efficient use of existing facilities to reach higher production goals.

A survey of your plant by experienced engineers of the Lester B. Knight organization will enable you to learn ways and means to step up your production figures. You will probably be surprised, as others have been, how a few simple modernization measures can make such an improvement in your operations.

You can depend on Knight engineers to give you a quick, accurate analysis of your present operations and to outline a series of corrective measures to solve existing problems. Their recommendations are based on 10 to 25 years of foundry management, engineering and equipment experience.

No job is too small and no job is too large for the Knight organization. Whether you need a reorganization of departments, installation of cost control, job evaluation, standards, incentives, modernization or mechanization, temporary operation or management, or the design, installation and operation of a complete new plant, Knight can do the job for you.

With the present staff of widely experienced specialists, the Knight organization is in an excellent position to be of valuable service to you.

KNIGHT Service for Foundries:

- Foundry Engineering
- Architectural Planning
- Foundry Layout
- Foundry Modernization
- Foundry Management
- Industrial Engineering; Job Evaluation, Incentives
- Production and Cost Control

LESTER B. KNIGHT & ASSOCIATES INC.

Consulting · *Engineers*

600 W. JACKSON BLVD.
CHICAGO 6, ILLINOIS

30 CHURCH STREET
NEW YORK 7, NEW YORK

CONSULTING SERVICE
for Management · Sales · Production

ENGINEERING SERVICE
for Surveys · Modernization · Mechanization

NOW AVAILABLE—
FOR IMMEDIATE DELIVERY

DE-SUL-FLUX

THE GRANULAR
DE-SULPHURIZING SODA ASH

A proven, quick-melting flux giving you two important, money-saving advantages:

1. It refines the structure of the metal and removes non-metallic elements . . . thus assuring stronger castings.

2. It permits the use of raw materials of higher sulphur content, with a resulting mixture well within the sulphur limit.

Many foundrymen have found that they can realize greater profits, and deliver higher quality castings, by using DE-SUL-FLUX for refining and desulphurizing metal in the ladle.

DE-SUL-FLUX is easy to use, too. Dustless, free-flowing and granular in form, it comes in 100-pound bags or bulk carlots.

Right now the demand for DE-SUL-FLUX is greater than ever. Increased production facilities, however, enable us again to accept orders in carload quantities.

The Great Lakes Line

•

Juniata Bank Sands
(Natural and Dried)
Indiana Bank Sand
Lake Core Sands
(Natural and Dried)
Molding Sands
Ottawa Silica Sands
Crude Silica Sands
Diamond Blast Sand
Flint Shot Blast Sand
Gold Jacket Blast Sand
Muscatine Blast Sand
Steel Shot and Grit
Stoody Borium Nozzles
Mill Stars
Bentonite (Volclay and
Panther Creek)
Rebonding Clays
Fire Clays
A.B.C. Foundry Coke
Fire Brick
Firestone
Silica Grits
Ganister-Firean
Inland Limestone
Fluorspar-Dolomite
DE-SUL-FLUX
Malleabrasive
Chrome Ore
Nepheline Syenite

Great Lakes Foundry Sand Co.

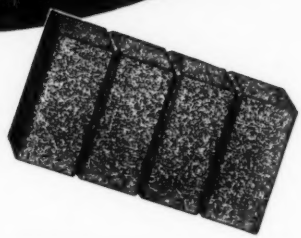
UNITED ARTISTS BLDG. DETROIT, MICHIGAN

De-Sul-Flux is a product of
WYANDOTTE CHEMICALS CORPORATION
Sold and Serviced by
GREAT LAKES FOUNDRY SAND CO.

MINERS — PROCESSORS — FOUNDRY, METALLURGICAL AND SAND BLAST SERVICE

CASTING AILMENTS

One or more can cause Rejects



SCORED BRICK FORM

makes fluxing of iron a matter of seconds.

No digging out of container.
No weighing. No measuring.

You simply toss Famous Cornell Flux into cupola with each ton charge of iron or break off one to three briquettes (quarter sections) for smaller charges. Flux in this form does not blow out with the blast but STAYS in melting zone until entirely consumed, insuring fullest efficiency.

Write for Bulletin 46-B

Foundrymen know that most casting rejects are due to impure metal and improper heats—and many have "done something" about it by turning to Famous Cornell Cupola Flux.

Famous Cornell Cupola Flux is a metal cleansing medium that has been in constant use in the cupolas of leading foundries—for years. It not only purges molten metal of impurities, but makes molten iron hotter and freer flowing, and there is a *very noticeable reduction of sulphur*. Castings come sounder, cleaner and are easier to machine.

Cupolas, too, give more efficient and less interrupted production. Bridging over is greatly reduced. Drops are cleaner.

• • •

● **MALLEABLE FOUNDRIES,** with cupola operation, are showing a rapid trend towards the use of Famous Cornell Cupola Flux. Reports of greatly improved casting production come from every direction. Furthermore, there is a considerable reduction in cupola maintenance labor and cost. The life of cupola lining, whether brick or stone, is greatly prolonged.

The **CLEVELAND FLUX** *Company*

1026-1034 MAIN AVENUE, N. W., CLEVELAND 13, OHIO

Manufacturers of Iron, Semi-Steel, Malleable, Brass, Bronze, Aluminum and Ladle Fluxes —Since 1918.

FAMOUS CORNELL FLUXES
Trade Mark Registered

Write for Bulletins

Famous CORNELL ALUMINUM FLUX	*Famous* CORNELL BRASS FLUX	*Famous* CORNELL LADLE FLUX
Produces clean, tough castings. No spongy or porous spots even when more scrap is used. Thinner yet stronger sections are poured. Castings take a higher polish. NO FUMES! Exclusive formula prevents obnoxious gases. Metal does not cling to dross.	Makes metal pure and clean, even when dirtiest brass turnings or sweepings are used. Produces castings which withstand high pressure tests and take a beautiful finish. Saves considerable tin and other expensive metals. Crucible and furnace linings are preserved.	Place a few ounces in bottom of ladle, then tap cupola. Metal is thoroughly cleansed, foreign impurities are easily skimmed off. Ladles are kept clean, there is less patching and increased ladle life. Metal temperatures are retained during transfer to molds.

HEAVY DUTY CRANKSHAFTS
cast in High Test
NICKEL ALLOY IRON

Crankshafts ranging from 800 to 4000 pounds in weight, and from 6 to 18 feet in length . . . for large Diesel engines in marine, locomotive, and stationary power plants . . . are now produced commercially by Pacific Car & Foundry Company's efficient new casting method.

The photograph shows an unmachined 8-throw unit that weighs 2105 pounds. It was cast in high strength nickel-molybdenum gray iron at Pacific's foundry in Renton, Washington.

This nickel alloy iron, produced as an inoculated iron in the basic electric furnace, consistently meets strength specifications of 60,000 to 75,000 p.s.i.

Each shaft is stress-relief annealed, and x-rayed to detect possible internal defects.

These nickel-molybdenum cast iron crankshafts provide:

- **Low Notch Sensitivity**
- **Excellent Vibration Damping**
- **High Resistance to Fatigue**

Avoidance of expensive dies and forging equipment, the use of cores to eliminate unnecessary metal, and the fact that castings require less machine tool time . . . point to the economy of using nickel alloy irons.

Heavy duty crankshafts indicate the wide scope of applications for high strength nickel alloy cast irons. Our casting specialists will be glad to consult with you and suggest where nickel cast irons may be useful to you. Write us today.

This high test nickel iron crankshaft is cast in a mold set horizontally, and tilted slightly while pouring. Mounted in specially designed trunions, the mold is rotated 90° to the vertical position for cooling. This provides better feeding, improved directional solidification, and thus, sound castings.

EMBLEM OF INCO SERVICE TRADE MARK

Over the years, International Nickel has accumulated a fund of useful information on the properties, treatment, fabrication and performance of engineering alloy steels, stainless steels, cast irons, brasses, bronzes, nickel silver, cupro-nickel and other alloys containing nickel. This information is yours for the asking. Write for "List A" of available publications.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N.Y.

...reports...

"uniform sand quality... unbelievably low maintenance costs"

...using

SIMPSON MIXERS

Illustrated below is a view of the two Simpson Intensive Mixers installed at the Omaha Steel Works foundry to provide better sand at lower cost.

OMAHA STEEL WORKS
STRUCTURAL STEEL · ORNAMENTAL IRON
STEEL CASTINGS · MACHINE WORK
609 SOUTH 48th STREET
OMAHA, 6, NEBRASKA

December 10, 1946

National Engineering Company
549 West Washington Boulevard
Chicago 6, Illinois

Attention: Mr. L. G. Probst,
Foundry Engineer

Gentlemen:

It seems proper on this, the third anniversary of our operation of our new steel foundry unit, to compliment you and to thank you for the efficiency of the sand handling system that you installed in our plant.

As you will recall, at the time we authorized the installation, we already had in our old foundry a Simpson Mill, and, while we were pleased with the performance of the old mill, we foresaw the greater efficiency of the new Simpson Mills that you recommended. We have not been disappointed. The quality of our sand mixes has been uniform, and our maintenance costs have been low. In fact, the maintenance costs of the whole sand handling system have been unbelievably low.

We have not tried for any record in reducing the amount of new sand used as we have often felt that, if this is overdone, the cleaning room costs raise and offset the economy in sand consumption. We can say, however, that during the three years of operation of the new foundry our percentage of loss of castings from all causes has been less than 1/2 of 1 percent.

Again we express our appreciation to you for a Job well done.

Yours very truly,

OMAHA STEEL WORKS

Paul H. Leussler

Paul H. Leussler
Vice President

PHL:gg

ALL ORDERS ARE ACCEPTED SUBJECT TO STRIKES, ACCIDENTS, CAR SUPPLY AND OTHER CAUSES OF DELAY BEYOND OUR CONTROL

The Omaha Steel Works is only one of many up-to-date foundries that *depend* on Simpson Mixers and National Sand Handling Systems for *high output* of completely uniform sand mixes. Low operating and maintenance costs add appreciably to the satisfaction that Simpson Mixers give their owners.

National Engineering and Field Service is available to help solve your sand handling problems. Write for complete details.

MANUFACTURER'S ASSOCIATION INC. FOUNDRY EQUIPMENT

NATIONAL ENGINEERING COMPANY

600 MACHINERY HALL BUILDING • CHICAGO 6, ILLINOIS

Manufacturers and Selling Agents for Continental European Countries—The George Fischer Steel & Iron Works, Schaffhausen, Switzerland. For the British Possessions, Excluding Canada and Australia—August's Limited, Halifax, England. For Canada—Dominion Engineering Co., Ltd., Montreal, Canada. For Australia and New Zealand—Gibson, Battle & Co., Pty., Ltd. Sydney, Australia

PRODUCTION CONTROL
Key to Lower Costs
BETTER CASTINGS

TODAY more than at any previous time, foundrymen face the problem of producing better castings at lower costs. As costs mount the problems of improved methods and better production control become more urgent and increasingly difficult to solve. An essential phase of modern foundry operation, production control was the subject of the 1948 A. F. S. Annual Lecture Series. The five papers, presented at the 52nd Annual A. F. S. Convention in Philadelphia, will appear serially in AMERICAN FOUNDRYMAN with the first—on steel—in this issue.

Several important phases of production control well worth every foundryman's consideration are:

1. Good Maintenance Plan: A great deal less downtime and therefore additional production will result if a good maintenance plan is established and followed. Preventive maintenance is an essential component of any such plan.

2. Equipment Design: Watch equipment design so that inherent faults will not be built into new layouts and processes.

3. Casting Design: Keep close contact with casting designers so that basic foundry experience is used to simplify casting engineering. This reduces costs by eliminating troubles that can be foreseen and is significant if continuing cooperation between designer and producer is to be an accepted procedure.

4. Material and Process Control: Control of materials such as sand, sand mixtures, pig iron, scrap and refractories is absolutely essential to economical castings production. It is reasonable to assume that variations in the materials going into the molds and the molten metal will result in variations in the castings, sometimes creating much larger losses than are anticipated. Close control of production processes is also of utmost importance and cannot be overemphasized. All types of control must be taken out of the field of guessing and placed on a plane where variations cannot occur if it is humanly possible to prevent them.

When analyzing the problem of casting control foundrymen should keep in mind that castings vary in structure and type of metal from section to section of the same casting. If these differences are studied carefully it is possible that changes in existing specifications can be made with a resultant benefit to the machine shop through increased tool life.

The casting of automobile cylinder blocks is a good example of a well controlled casting operation. Good core mixture control, and control of core setting and iron have accomplished what a few years ago was only a foundryman's dream. In our cylinder-block operation, for instance, 400 tons of metal, constantly checked for analysis, are continually held in a hot metal mixer ready for the molding lines. The metal is brought to the proper pouring temperature in an electric furnace.

Continual emphasis must be placed on foundry production control practices. Now, when some important foundry materials—such as coke, scrap and pig iron—are difficult to obtain, raw materials control is especially important.

F. C. RIECKS
National Director
AMERICAN FOUNDRYMEN'S SOCIETY

Manager of foundry operations for the Ford Motor Co., Dearborn, Mich., since 1947, F. C. Riecks has an international reputation as a foundry design and construction engineer. He joined Ford in the fall of 1916 as a power plant draftsman after graduating as a mechanical engineer from the University of Michigan earlier that year. Since then, he has worked for Ford in this country and abroad with the exception of a period in World War I when he was in the artillery and later in the air corps. Mr. Riecks' activities in various Ford plants and departments have acquainted him closely with maintenance and construction, accounting, and plant engineering and design, not only in connection with foundry operations but also with open hearth, steel mill, glass plant, and forge plant operations. His overseas Ford assignments included work in China, Japan, and France. He designed and constructed many World War II projects.

ANNOUNCE TENTATIVE PROGRAM

for 1949 Annual A.F.S. Foundry Congress

The St. Louis Art Museum, picturesquely situated in Forest Park, houses one of the country's finest collections of paintings and art.

WITH HOUSING APPLICATIONS already in the hands of A.F.S. members and the tentative program set up, preliminary activities of the 1949 Annual A.F.S. Convention are well under way. To be held in St. Louis, May 2-5, the Society's 53rd Foundry Congress will consist of four days of technical meetings, round table luncheons, division business meetings, and special sessions. Climaxing the event will be the Annual Banquet, the evening of Thursday, May 5, at which Gold Medals and Honorary Life Memberships will be awarded. One of the features of the four day round of sessions is the Annual Business Meeting and the Charles Edgar Hoyt Annual Lecture scheduled for the afternoon of Wednesday, May 4.

Grouping of meetings by A.F.S. Division and general foundry interest enable foundrymen to attend the maximum number of sessions in the minimum number of days. Thus, those planning to attend the Annual Meeting of A.F.S. can request housing space on the basis of the tentative schedule (see facing page) well in advance of February 15 when assignment of rooms will start.

Housing assignments for the 1949 A.F.S. Foundry Congress will be made by the St. Louis Hotels Reservation Bureau. Commitments have been received from the major St. Louis hotels for a number of rooms deemed sufficient to accommodate all who plan to attend. Nevertheless, foundrymen are urged to send their housing applications at the earliest possible time to: St. Louis Hotels Reservation Bureau, 1420 Syndicate Trust Bldg., St. Louis 1, Mo.

Sessions planned for the 53rd Annual Meeting of A.F.S. include five for aluminum and magnesium foundrymen, four each for brass and bronze, malleable and steel foundrymen; seven for gray iron; six for sand; three for education; and two for pattern. One meeting has been planned to cover each of the following: heat transfer; time study and methods; costs; refractories; and plant and plant equipment.

Two joint meetings, an unusual feature of this year's convention will be for gray iron and malleable and for gray iron and steel foundrymen. The gray iron-malleable session will be a symposium on nodular graphite cast iron. Metal flow in finger gates and step gates will be shown by motion picture and discussed at the gray iron-steel joint meeting.

For the first time, a Gray Iron Round Table Luncheon will be held at the 1949 A.F.S. Convention. Not scheduled in the past because the Gray Iron Shop Course adequately met needs for informal, discussion-type meetings, the luncheon has been arranged for this year's Convention in response to popular demand. As in the past, round table luncheons have been set for aluminum and magnesium, brass and bronze, malleable, pattern, and steel. A dinner for foundrymen and educators will be held again this year to provide an opportunity to exchange views on foundry education problems.

Continuing a practice of many years standing, the popular and heavily attended Gray Iron Shop Course and Sand Shop Course have been scheduled for 8:00 p.m. Monday, Tuesday, and Wednesday, the first three days of the Convention. Informal discussions in which many in the audience participate, the shop course sessions are scheduled for evenings to enable the greatest number of operating foundrymen to attend. These meetings are marked by free interchange of helpful hints and practical foundry-tested ideas.

Frederick H. Rein, *secretary and general manager of the St. Louis Convention and Publicity Bureau, who will coordinate handling of housing, registration, and the thousand-and-one problems which arise when a city plays host to the Annual Convention of the American Foundrymen's Society.*

Scheduled for the Gray Iron Shop Course are: *"Inexpensive Tests for the Small Gray Iron Foundry,"* with Walter Bohm, Buick Motor Co., Flint, Mich., as discussion leader; *"Carbon Trends in Gray Iron,"* with W. W. Levi, Lynchburg Foundry Co., Radford, Va., leading the discussion; and a panel discussion on *"Sources of Metal Losses in the Foundry."* Five well-qualified foundrymen, headed by James Bernard of Buick, will make up the panel.

At the Annual Business Meeting, scheduled for 2:00 p.m., Wednesday, May 4, President W. B. Wallis will make the presidential address, officers and directors will be elected for the coming year, Apprentice Contest awards will be made, and the Charles Edgar Hoyt Annual Lecture will be presented. Annual Lecturer for 1949 is John Howe Hall, foundry consultant and a member of the A.F.S. Steel Division Advisory Group, who will speak on *"Composite Structures Utilizing Steel Castings and Welding Methods."*

Presentation of awards by President Wallis to the first place winners in the four divisions of the 1949 Annual A.F.S. Apprentice Contest climaxes this annual event, now in its 26th year, which opened October 15, 1948. Closing date is March 15.

Rounding out the four days of Convention activity is the Annual Banquet, last of a series of luncheon and dinner meetings which are A.F.S. Foundry Congress traditions. These meetings start with the Engineering School Graduates Luncheon on Monday, May 2, and include the Chapter Officers and Directors Dinner and the Canadian Dinner, both at 7:00 p.m., Tuesday, May 3. The A.F.S. Alumni Dinner, set for 7:00 p.m., Wednesday, May 4, again will bring together past and present officers and directors of the Society, and holders of A.F.S. Gold Medals and Honorary Life Memberships.

Special registration in the Canadian and the International Guest Books will take place at a booth near A.F.S. Convention Headquarters. Not required as is registration to participate in general Foundry Congress activities, the guest registration booth provides a convenient meeting place for international visitors. Examination of the book is often the means of locating a friend not known to be in attendance.

Plant visitations, long a feature of A.F.S. Conventions and another evidence of the cordiality and willingness to exchange information and ideas which marks A.F.S. members, are being arranged for the 53rd Annual A.F.S. Foundry Congress by the St. Louis District Chapter.

For the ladies, there will be a program of entertainment and visits to historic and scenic spots.

Tentative Schedule of Sessions

53rd Annual Meeting of the American Foundrymen's Society
St. Louis — May 2-5

Monday, May 2

8:30 a.m.	Registration Begins
10:00 a.m.	Technical Sessions Aluminum & Magnesium Brass & Bronze Malleable
12:00 noon	Aluminum & Magnesium Round Table Luncheon Engineering School Graduates Luncheon
2:00 p.m.	Technical Sessions Brass & Bronze Malleable
4:00 p.m.	Technical Sessions Aluminum & Magnesium Malleable
6:30 p.m.	Educational Dinner
8:00 p.m.	Technical Sessions Gray Iron Shop Course Sand Shop Course

Tuesday, May 3

10:00 a.m.	Technical Sessions Aluminum & Magnesium Brass & Bronze Heat Transfer
12:00 noon	Brass & Bronze Round Table Luncheon Malleable Round Table Luncheon
2:00 p.m.	Technical Sessions Aluminum & Magnesium Pattern Sand Time Study & Methods
4:00 p.m.	Technical Sessions Cost Gray Iron & Malleable — Joint Session Refractories; Sand
7:00 p.m.	Chapter Officers & Directors Dinner Canadian Dinner
8:00 p.m.	Technical Sessions Gray Iron Shop Course Plant & Plant Equipment Sand Shop Course

Wednesday, May 4

10:00 a.m.	Technical Sessions Gray Iron; Sand; Steel
12:00 noon	Pattern Round Table Luncheon
2:00 p.m.	Annual Business Meeting
2:45 p.m.	Charles Edgar Hoyt Annual Lecture
7:00 p.m.	A. F. S. Alumni Dinner
8:00 p.m.	Technical Sessions Gray Iron Shop Course Gray Iron & Steel — Joint Session Sand Shop Course

Thursday, May 5

10:00 a.m.	Technical Sessions Gray Iron; Steel
12:00 noon	Gray Iron Round Table Luncheon Steel Round Table Luncheon
4:00 p.m.	Technical Sessions Gray Iron; Steel
7:00 p.m.	Annual Banquet

ANNOUNCE 1949 NOMINATIONS FOR OFFICERS AND DIRECTORS

E. W. Horlebein

of

American Foundrymen's Society

W. L. Woody

E. W. HORLEBEIN, PRESIDENT AND GENERAL MANAGER, Gibson & Kirk Co., Baltimore, Md., was nominated President of the American Foundrymen's Society for 1949-50 at a meeting of the Nominating Committee, December 13, 1948, at the La Salle Hotel, Chicago. Nominated as Vice-President for the same one-year term was Walton L. Woody, vice-president, National Malleable & Steel Castings Co., Cleveland.

Director nominees for three-year terms are:

T. E. Eagan, chief metallurgist, Cooper-Bessemer Corp., Grove City, Pa.

L. C. Farquhar, Sr., works manager, American Steel Foundries, East St. Louis, Ill.

V. J. Sedlon, president, Master Pattern Co., Cleveland.

F. G. Sefing, research metallurgist, International Nickel Co., New York.

L. D. Wright, superintendent, U. S. Radiator Co., Geneva, N. Y.

W. B. Wallis, president, Pittsburgh Lectromelt Furnace Corp., Pittsburgh, whose term as President of A.F.S. expires in 1949, will continue as a director for a year.

Election of officers and directors will take place at the Annual Business Meeting of the Society, one of the sessions at the Annual Meeting to be held in St. Louis, May 2-5. New A.F.S. officials will take office immediately following the annual meeting of the Board of Directors to be held in July.

Directors completing terms in July, 1949, are:

Max Kuniansky, vice-president and general manager, Lynchburg Foundry Co., Lynchburg, Va., A.F.S. President during 1947-48.

H. A. Deane, vice-president, Brake Shoe & Castings Div., American Brake Shoe Co., New York.

J. E. Kolb, pattern shop superintendent, Caterpillar Tractor Co., Peoria, Ill.

H. G. Lamker, foundry superintendent, Wright Aeronautical Corp., Wood Ridge, N. J.

B. L. Simpson, president, National Engineering Co., Chicago.

S. C. Wasson, manager, Chicago and Melrose Park plants, National Malleable & Steel Castings Co.

Nominations for officers and directors of the A.F.S. for election at the 1949 Annual Business Meeting are announced in accordance with the By-Laws which require that the report of the Nominating Committee be published at least 60 days prior to the Meeting. Thereafter and at any time 45 days prior to the date of the Annual Business Meeting additional nominations may be made by written petition filed with the secretary of the Society and signed by 35 members in good standing.

Should no candidates be nominated by petition, the secretary *"shall, at the annual Business Meeting, cast the unanimous ballot of all members for the election of the candidates named in the report of the Nominating Committee, and as published to the membership"* as prescribed by the By-Laws. If additional candidates are nominated by petition, the By-Laws require that elections shall be by letter ballot.

The Nominating Committee which selected the candidates for the 1949 election was headed by Past President Max Kuniansky, who, as immediate Past President, was chairman. Past President (1946-47) S. V. Wood, president and manager of Minneapolis Electric Steel Castings Co., Minneapolis, and the following were members of the committee:

F. G. Sefing

T. E. Eagan

Alexander C. Andrew, foreman, American Locomotive Co., Schenectady, N. Y., representing the Eastern New York Chapter and gray iron.

C. E. Shaw, works engineer, American Steel Foundries, Alliance, Ohio, representing the Canton District Chapter and steel.

Howard B. Voorhees, foundry superintendent, Peru Foundry Co., Peru, Ind., representing the Michiana Chapter and gray iron.

George W. Zabel, general superintendent of foundries, Fairbanks-Morse Co., Beloit, Wis., representing the Northern Illinois-Southern Wisconsin Chapter, gray iron, and brass and bronze.

Paul L. Arnold, resident manager, U. S. Pipe & Foundry Co., Chattanooga, Tenn., representing the Tennessee Chapter and gray iron.

J. O. Klein, vice-president, Texas Foundries, Inc., Lufkin, Texas, representing the Texas Chapter, malleable iron and aluminum.

Anton Johnson, works manager, Oklahoma Steel

V. J. Sedlon

L. C. Farquhar

Castings Co., Tulsa, Okla., representing the Tri-State Chapter and steel.

The five members of the Nominating Committee, in addition to the two immediate Past Presidents of the Society, are chosen by the Executive Committee of the Board of Directors from the list of candidates submitted by the various eligible chapters. One member of the Nominating Committee may be from the list of members in the United States, Canada and Mexico not residing in a chapter area. A chapter is not eligible to have a member on the committee if represented during the previous two years.

Announcement of this year's nominating Committee was made in the September, 1948, issue of AMERICAN FOUNDRYMAN, in accordance with the By-Laws which require that such announcement be made not later than November 15 of each year.

All the nominees for officer or directorship in the American Foundrymen's Society have been active in the foundry industry and have been prominent in the technical activities of the Society for many years. Several have served or are now serving as chairmen of one of the eight A.F.S. technical divisions.

Mr. Horlebein, nominee for President, is now Vice-President of A.F.S. and is well acquainted with Society and chapter problems. He completed a three-year term as National Director in 1948. Mr. Woody, Vice-Presi-

L. D. Wright

W. B. Wallis

dential nominee, was a National Director during 1942-1945.

Continuing members of the Board whose terms expire in 1950 are:

E. N. Delahunt, general superintendent, Warden King, Ltd., Montreal, Que.

W. J. MacNeill, assistant to the president, Dayton Malleable Iron Co., Dayton, Ohio.

F. C. Riecks, foundry manager, Ford Motor Co., Dearborn, Mich.

J. M. Robb, Jr., resident manager, Hickman, Williams & Co., Philadelphia.

A. C. Ziebell, president and general manager, Universal Foundry Co., Oshkosh, Wis.

Directors whose terms expire in 1951 are:

T. H. Benners, Jr., T. H. Benners & Co., Birmingham, Ala.

N. J. Dunbeck, vice-president, Eastern Clay Products, Inc., Jackson, Ohio.

Robert Gregg, foundry manager, Reliance Regulator Corp., Alhambra, Calif.

A. M. Fulton, vice-president, Northern Malleable Iron Co., St. Paul, Minn.

V. E. Zang, vice-president, research and development, Unitcast Corp., Toledo, Ohio.

National President Wallis Visiting All Chapters During Term Of Office

STARTING IN SEPTEMBER, 1948, A.F.S. President W. B. Wallis commenced a tour of North America which will take him to every Society chapter, regional foundry conference, and a number of meetings of other foundry organizations. Included on his itinerary are the A.F.S. student chapters, the 53rd Annual Convention of the Society in St. Louis, May 2-5, and the 6th Annual Chapter Officers' Conference to be held in Chicago, June 27-28.

Following a prearranged schedule, Mr. Wallis is meeting with chapter boards of directors and committee chairman to bring them up-to-date information on national A.F.S. activities and to assist them in carrying out recent actions of the National Board of Directors. To date he has visited 14 chapters, installed the Oregon State College Student Chapter, and has attended the All-Canadian Foundry Conference, the New England Regional Foundry Conference, and the FEMA Annual meeting.

Eighteen Days BEHIND THE "IRON CURTAIN"

Lester B. Knight
President
Lester B. Knight & Associates
Chicago

As OFFICIAL DELEGATE of the American Foundrymen's Society to the first postwar International Foundry Congress, held in Prague, Czechoslovakia, September 15-26, I have been one of the privileged few who have had a glimpse of an industry at work behind the Soviet "Iron Curtain." During an 18-day journey I have seen the Five Year Plan at work in Czechoslovakia, where virtually all of the country's 682 foundries (250 gray iron, 12 malleable, 20 steel and 400 non-ferrous) are nationalized.

Czechoslovakia's total annual production of ferrous castings for 1948 was about 300,000 long tons, or about 110 per cent of 1929 production and 400 per cent of 1945 production—indicating not only a substantial recovery from the German occupation, but an improvement over prewar production.

As in most countries, the foundries of Czechoslovakia consist of many small units with a few large units producing the bulk of the tonnage. For example, 3 per cent of the gray iron foundries produce 34 per cent of the tonnage, with average annual output of 10,000 tons per plant. Of the gray iron foundries, 49 per cent produce only 6 per cent of the tonnage, with average annual production of 120 tons, another 31 per cent produce an additional 18 per cent averaging 500 tons per year per foundry, and 17 per cent produce approximately 42 per cent and average approximately 2,000 tons per year per foundry. The 12 malleable foundries, each part of another foundry unit, average 1,000 tons apiece per year. Most of the malleable iron is melted in induction furnaces. The 20 steel foundries each average approximatly 4,000 tons per year, with the largest producing 12,000 tons of steel annually.

In 1948, gray iron castings accounted for 83 per cent of the total ferrous casting production, malleable 2 per cent, and steel 15 per cent.

In general, foundry operations in Czechoslovakia are manual. Working conditions encountered ranged from "poor" to "excellent," with most "fair-to-good." Housekeeping practices varied widely from plant to plant but also get a "fair-to-good" rating with some "excellent," both in small and large plants. There are no large plants tonnage-wise as we know them, although many of the foundries are equipped to produce castings weighing from a few ounces to more than 30 tons.

Virtually no attempt has been made to establish specialized foundries, with the result that most are jobbing shops making castings for sewing machines, engines, turbines, general machinery, farm implements, machine tools, etc. Methods are similar to those in our own "old fashioned foundries" in that the molder generally services himself, pours his own iron, fits his cores and if not satisfied with his heap of sand, recuts

A.F.S. delegate Lester B. Knight, photographed at High Tatras, Czechoslovakia, with three of Czechoslovakia's most prominent foundrymen. Left to right: Dr. Ing. J. Koritta, technical manager, Czechoslovak Metal and Engineering Works; Mr. Knight; Dr. Ing. Fabinger, general manager, Czechoslovak Metal and Engineering Works; and Ing. O. Starosta, technical manager, JAWA foundry. Koritta and Starosta are A.F.S. members and attended the 1947 Convention.

it himself. A few of the foundries have central sand preparation units and belt distribution but have not learned to make use of such mechanical equipment to secure the greatest possible unit and total production.

Molders are reluctant to allow anyone else to pour their work. There are very few molding machines, air rammers, and other labor saving production tools in Czech foundries. The molding machines, air rammers, etc. that were observed were not sturdy enough to stand up under high production. The need for American equipment and American production know-how was most apparent.

Czechs Far Behind U.S. In Production

To say that the Czechoslovak foundries visited are behind the United States foundries in production rigging, and production methods and facilities is an unbiased statement.* Establishment of modern foundry practices in Czechoslovakia will require a tremendous educational program for workers, supervision and management, plus full cooperation of the workers, who have evidenced a sharp disinclination to use any equipment that will increase unit production per man hour of effort and total daily production per man.

One classic example of this is a small foundry where overhead sand was installed with a roller conveyor to handle the molds from the machines to pouring zones and to dumping stations. The molders insisted on dumping the sand on the floor (later shovel type hoppers were installed) and refused to use the roller conveyor, preferring to carry the molds out to the end. When management attempted to enforce the proper use of the roller conveyor, the molds were damaged. On the other hand, in another shop where a roller conveyor is used, after some initial education the men now refuse to carry out the molds.

Virtually all direct labor operations are based on wage incentives stemming from direct time study or on synthetic standards developed from time study. The unions insist on incentive pay. In fact, all the foundries visited in France, Switzerland, and England used wage incentives. Although all workers in these countries have received, since the end of the war, at least as many wage increases as have been given in the United States, the wage scale is very much lower than in the United States for comparable skill—not only in dollars but also in purchasing power.

From 1945 until February, 1948, approximately 85 per cent of Czechoslovakia's economy was either nationalized, local-government-owned or "co-operatized" by State cooperatives. Since February, 1948, an additional 10 per cent of the economy has been nationalized. The remaining "free enterprises," the very small retail stores and industries, must buy from the cooperatives and sell at State controlled prices so that, inevitably, they will either become State-owned or cease to exist and the present owners will become State employees. Not a technical paper of the type usually published in *American Foundryman*, this report to the A. F. S. membership by Lester B. Knight, Lester B. Knight & Associates, Chicago, official A. F. S. delegate to the International Foundry Congress, gives an eye-witness account of foundry conditions in Czechoslovakia and cites authentic production figures. Information not ordinarily available to foundrymen outside of Czechoslovakia is given in this article.

For example, in Czechoslovakia a skilled molder on incentive will average approximately 25 crowns (50c) per hour, coremakers 21 crowns (42c) per hour, cleaners 22.5 crowns (45c) per hour, and helpers 17 crowns (34c) per hour. In Switzerland, the molders' incentive wages average 50c per hour, in France 120 francs (approximately 30c) per hour, and in England 2 shillings (approximately 40-50c) per hour.

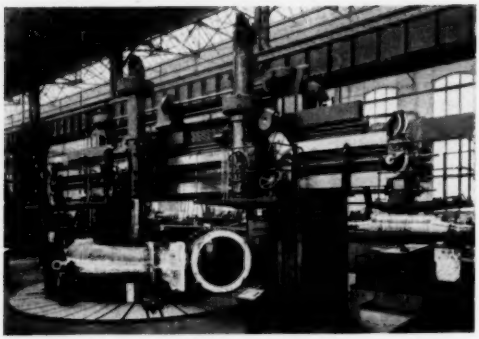
In Czechoslovakia, the work week is usually 45 hours—a day shift from 6 a.m. to 2 p.m. and 5 hours on Saturday. Most larger plants are working two and three shifts in various departments and it is reported that in spite of or because of extremely strong unionism, there have been no work stoppages since the Germans were driven out in 1945.

Czchoslovakian blast furnaces have abundant good metallurgical coke containing less than 0.5 per cent sulphur. They produce approximately 100,000 tons of pig iron per year for foundries and in 1948 secured an additional 50,000 tons of machine cast pig from the U.S.S.R. as part of the trade agreement under which Russia reportedly receives approximately 45 per cent of all Czechoslovakian manufactured products.

It was most interesting to see the high quality of

* EDITOR'S NOTE: Foundrymen visiting the United States are most often interested in high production techniques. Some spend up to a year in this country studying U. S. foundry methods.

Delegates from ten nations attended the first postwar International Foundry Congress, Prague, Sept. 15-26.



Spiral turbine case weighing more than 35 tons, in process of machining at a Czechoslovakian plant.

castings of all types produced in these foundries, particularly in view of the complete lack of high quality sands, oil, cereal binders, bentonite or high quality refractory clays for synthetic sands. This is roughly similar to trying to make jacket cores using sulphite and molasses as binders. Naturally, core blowers have not been used successfully. A few German and English machines have been tried but none was being used in any of the plants visited.

With the poor quality of sands and binders, virtually all of the medium and larger sizes of castings are produced in oven-dried molds. Practically all ovens are hand-coke-fired with no recirculation of air. This results in non-uniform baking yet, the quality of the castings is good and scrap losses generally are lower than in the United States today.

Czechoslovakia has generally adopted the use of the Skoda cupola, which is a modified balanced blast type of unit. All units have a forehearth to insure greater uniformity of composition and temperature. Because of the availability of satisfactory coke, most of the observed figures indicated melting ratios of 9 to 1 or higher with iron of 2750 F at the spout. There are some side dump and bottom dump chargers in use. No large cupolas were observed—most were lined to 48 in. diameter or smaller.

In the steel foundires, most medium and large castings are produced in dry sand molds. Risers and gates are usually more than adequate with resultant low yield. Only open risers are used. The larger alloy, heat resistant and pressure-type castings are made in chamote—similar to the so-called "Fischer Process." It is interesting to note that the material sold by Fischer is mined and semi-processed in Czechoslovakia.

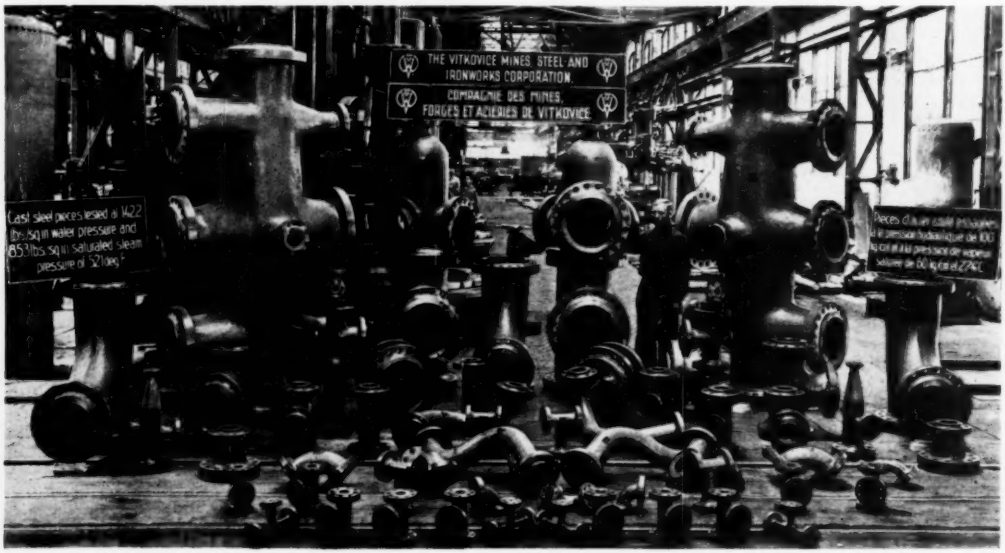
Open hearth, direct arc, acid and basic, and induction furnaces are used for steel melting. The refusal by the United States to grant exports licenses for electrodes is causing the re-use of some side-blow converters. All types of steel castings are produced in all sizes up to 50 tons. Alnico magnet steel is produced without cobalt, and is a satisfactory substitute although the conventional alloy would be used if the cobalt were available.

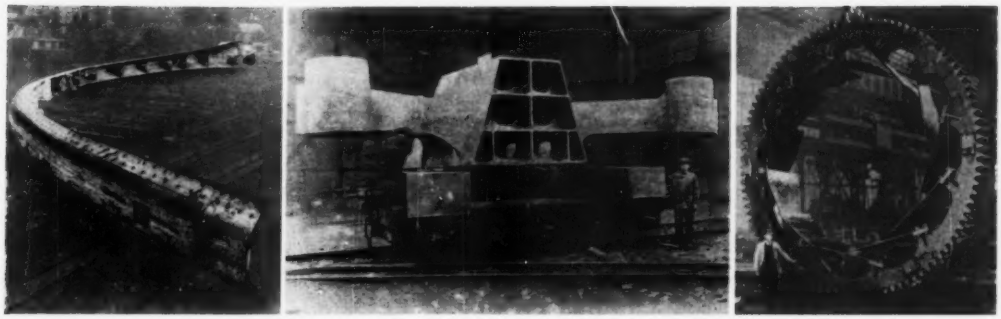
Brass and bronze castings are available only under highest priority because of the extreme shortage of copper. Some die castings of bronze, as well as centrifugal casting of hollow bushings using the Holroyd process were observed.

Aluminum castings of secondary aluminum are widely used for automotive and motorcycle engines and similar parts. Die, permanent mold, semi-permanent mold and green and dry sand castings were observed. Nose-tilt type and pot-type producer gas and coke-fired melting units are most widely used.

It is of course difficult to compare modern American

Large variety of valves and fittings cast by Vitkovice Mines, Steel and Ironworks Corporation.





(Left) Seven-ton stern frame for a Dutch ship, cast in three parts and bolted. (Center) Propeller brackets, cast in Czechoslovakia for a Dutch firm, and weighing more than 16 tons. (Right) This 16-ton tooth rim was cast in six parts in the Vitkovice Mines, Steel & Ironworks Corp. foundry for use by a Danish manufacturer.

foundry practice with that in Czechoslovak foundries. If our production planning, rigging and methods were applied to their problem, a substantially higher unit production would permit higher wages, lower costs, and resultant higher standard of living. Apparently labor has been so inexpensive there has been no great incentive to develop methods and facilities to help production workers produce efficiently during the full working day. Allowing the producers to produce efficiently is the essence of modern foundry practice.

Man Hour Per Ton Requirements High

It is interesting to note the requirement in man hours per ton of good castings produced in the various metals and plants:

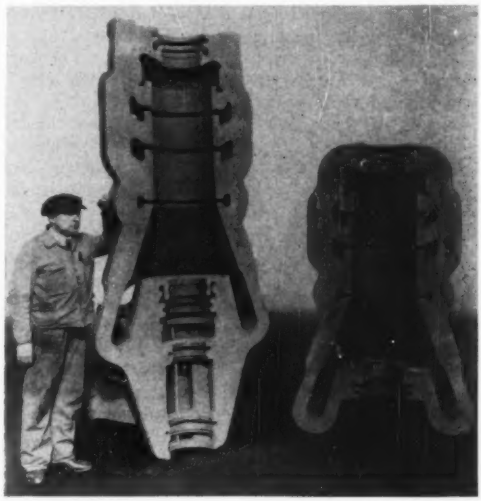
Gray Iron Castings	
Machine tools	83 to 140 man hours per ton
General machinery	77 to 150 man hours per ton
Farm machinery	70 to 110 man hours per ton
Commercial castings	70 to 135 man hours per ton
Rolls and ingots	15 to 45 man hours per ton
Malleable Castings	
Minimum	180 man hours per ton
Maximum	350 man hours per ton
Average	250 man hours per ton
Steel Castings	
Minimum	76 man hours per ton
Maximum	230 man hours per ton
Average	130 man hours per ton

The foregoing figures mean little for comparison without knowledge of the average weight of the casting, intricacy, coring, etc. It was generally observed that approximately 2½ to 6 times as many man hours per ton of good castings are required in Czechoslovakia as would be required in the United States in our modern foundries for the same class, weight and kind of casting. Many of our U. S. foundries are doing approximately the same as in Czechoslovakia but our modern shops are much more efficient.

The present Five Year Plan of Czechoslovakia requires that the foundry capacity of the country be doubled to 600,000 tons annually. This is to be accomplished by building new, specialized foundries, mechanized to a degree not heretofore known in Czechoslovakia and applying United States methods of production rigging and operation. Many of the older, inefficient plants will be eliminated. There will be only four malleable foundries, each with a production capacity of 5,000 tons per year, compared with the present 1000 tons per year for each of 12 foundries. The steel foundries will be modernized to permit greater unit and total production. There will approximately 37 fewer gray iron foundries, although total production will be doubled.

The present program of modernization and expansion of all industry in Czechoslovakia is reported to require expenditure of 23 per cent of the sales value of the manufactured products. Such a program, coupled with export of 45 per cent of production to U.S.S.R. has resulted in a great shortage of all goods for the Czech people themselves. In spite of greater production than in 1929 or 1938, food and clothing

This intricate turbine case was cast in two parts by a Czechoslovakian foundry. Weight: 96,000 lb.



and all consumer items are expensive, of not-too-good quality, and strictly rationed or non-existent. The strict rationing of motor fuel and stringent regulations against pleasure driving seem to be typical of the economy of England as well as of Czechoslovakia.

The reception accorded me was most cordial and hospitable. In every plant the president of the union, in addition to the management, made me welcome and expressed the hope that America would help Czechoslovakia work out its problems through trade agreements between the two nations. This would enable Czechoslovakia to increase production and efficiency and to maintain a higher living standard and greater security in a peaceful world.

I told the Czechs that Americans have always been ready to help all people who are willing to work on a basis of mutual helpfulness and understanding.

The larger Czech plants have provided pleasant personnel facilities and the extreme shortage of living quarters is being alleviated by a public housing program started in 1945 and pushed aggressively since. Many such programs are financed by city governments, others by the individual company, or by the state. The units inspected were four-room apartments with living room, kitchen and two bedrooms with bath, costing approximately 40-50,000 crowns ($8,000-$10,000).

There is, as in all countries I visited and in the United States, a critical shortage of skilled workers and supervisors, and the foundry industry is having difficulty attracting workers. In spite of this, the apprentice system is excellent. Virtually every department has 10 per cent apprentices or trainees who take four years to complete work in every department, usually starting in the pattern shop.

The procedure in the Skoda pattern shop, where approximately 300 men are employed, is designed to permit full production of patterns in spite of the shortage of skilled men. It also offers the opportunity to speed up the work and perhaps to measure the work and establish standards. A planning committee "breaks down" the work of producing large and intricate patterns into the required operations and no one man makes a complete pattern. Some do the roughing and pasting, others the machine operations (sometimes progressively), others the finishing, etc. The net result appeared to be a substantially greater production of excellent patterns requiring far fewer skilled patternmakers than would have been needed had each patternmaker been completing his assigned pattern. The failure of our patternmakers to train adequate additions and replacements may be met by a similar approach to the problem.

It was interesting to note the extreme courtesy between workers and management. No worker failed to tip his hat and no manager failed to reciprocate.

As may be noted on the map at the beginning of this article, my trip took me through many miles of a most interesting country. There were 10 other nations represented in the International Foundry Congress and each reported that the overall productivity in his country is similar to that of Czechoslovakia. All that is, except the U.S.S.R. chief delegate, who stated, "Czech foundries do not know what production is as compared to that in U.S.S.R. foundries."

Urge Early Entry In '49 Apprentice Contest To Facilitate Scheduling

WITH THE 1949 A.F.S. APPRENTICE CONTEST in full swing, contest patterns for the three molding divisions are of necessity being more tightly scheduled and organizations sponsoring contestants are urged to enter their apprentices as soon as possible to avoid the last-minute rush before the contest deadline, March 15, 1949. The contest is open to indentured apprentices in any shop who meet entrance requirements. Entries are not limited to shops represented in the American Foundrymen's Society.

Top Winners To Attend Convention

Competition is open in steel molding, gray iron molding, non-ferrous molding (including aluminum and magnesium molding as well as molding copper-base and other non-ferrous alloys), and patternmaking. Prizes of $100, $50, $25 will be awarded the three top winners in each division. All winners receive a certificate of recognition, and the four first prize winners will receive round trip rail and Pullman fare to the A.F.S. Annual Convention, to be held in St. Louis, May 2-5, 1949. Certificates and prizes will be presented by A.F.S. National President W. B. Wallis as one of the features of the Annual Business Meeting.

Contest Requirements and Information

The contest is open to any apprentice taking a training course of not less than three years' duration, who is not over 24 years of age on the day he competes in the contest. Veterans of World War II ar eligible if their age less their term of service is not over 24.

United States entrants are requested to apply, through their sponsors, to the American Foundrymen's Society, 222 West Adams St., Chicago, 6, Ill. For the first time, this year Canadian entrants are requested to apply directly to G. Ewing Tait. Dominion Engineering Works, Ltd., Box 220, Montreal, Que., in order to facilitate handling of patterns and castings through customs.

Several A.F.S. chapters, as in the past, will this year conduct local contests to select patterns and castings to be sent to St. Louis for final judging. Sponsors and entrants are urged to consult officials of the nearest A.F.S. chapter to see whether a local contest will be held, before entering directly in the national contest. Plants in areas where a chapter contest will not be held may conduct a plant contest to select entrants for the finals.

Blueprints for the pattern division of the contest and patterns for the molding divisions are furnished by A.F.S. This year, for the first time, patterns for the same castings will be used for all three molding divisions. Castings are expected to illustrate the types of gating and risering used for the various alloys.

Last day for entering the 1949 A.F.S. Apprentice Contest is March 15. Judging will take place in St. Louis early in April. All castings and patterns entered in the finals will be exhibited during the 1949 A.F.S. Convention in St. Louis, May 2-5. Prize winning castings and patterns will go on exhibit at the Museum of Science and Industry, Chicago, for a year.

HISTORIC HIGHLIGHTS *of the* CASTINGS INDUSTRY

RECORD CHRISTMAS SALES of Bruce L. Simpson's DEVELOPMENT OF THE METAL CASTINGS INDUSTRY have placed it on the A.F.S. all-time "best-seller" list. A masterful blending of the romance and technology of the art of founding, Mr. Simpson's beautifully illustrated 246-page book chronicles the glamorous history of the foundry industry from prehistoric times to the present—an ideal addition to every foundryman's, engineering student's and company library.

Beginning with the first crude attempts by prehistoric man to make use of native metals—generally believed to have taken place somewhere in the Eurasiatic "steppe" belt, today known as the Russian Black Sea area, some eight thousand years before the birth of Christ—DEVELOPMENT OF THE METAL CASTINGS INDUSTRY traces the infinitely slow evolution of the art of casting metals and their alloys.

As the Eurasiatic peoples developed the casting of metals for weapons, these same weapons proved superior to the stone weapons of their enemies, enabling them to conquer far and wide, and their knowledge gradually spread over the known world. The first castings were of copper, but as knowledge of the art grew and spread, other metals and alloys came into use, among them iron, tin and bronze.

Highest development of casting among early peoples took place in the Far East, where the Chinese produced bells and statuary by means of the lost-wax process that are even today regarded as great artistic triumphs.

The Colossus of Rhodes

Traveling westward with the advance of civilization, the art of founding became known in Egypt, then Greece and Rome, seats of ancient civilizations. One of the world's most fabulous castings, surviving today only in legends, was King Solomon's pool. Cast in bronze, it was a 15-foot bowl, over seven feet deep and weighing 45 tons, supported on eight bronze oxen cast separately from the bowl.

The Greeks contributed principally to the casting of iron and discovered tempering but are best known for the Colossus of Rhodes, one of the Seven Wonders of the Ancient World. A bronze statue of the god Apollo, the Colossus rose 105 feet into the air, with one foot on each bank of the harbor entrance. Ships passed under this tremendous statue composed of hundreds of castings bolted together and weighing 360 tons, for over 400 years until it fell during an earthquake.

The Romans themselves did not contribute materially to the advancement of the castings art, but they disseminated foundry knowledge throughout the Roman Empire, including Gaul and the British Isles, where the casting of iron and production of cementation steel was a major industry. Charlemagne, who ruled most of Western Europe after the fall of the Roman Empire, was an early patron of the founding arts. In Ireland, foundrymen were regarded as members of the nobility.

Shortly after the reign of Charlemagne, about 1000 A.D., two types of blast furnaces that formed the link between forge and blast furnace were invented—the wolf furnace of Belgium and the Osmund furnace of Sweden. With the addition of the water-driven bellows and a slightly higher stack, molten metal was produced directly from these furnaces.

Pig iron was first obtained early in the 14th century, when temperatures were reached that were high enough to melt the carburized metal and to enable slag to be removed. Simultaneously, the crucible and the ladle were improved, and the reverberatory furnace was developed in Italy. Loam was used extensively in Italy for molding and coremaking.

The bell and cannon founders were largely responsible for keeping the art of founding alive during the Middle Ages. Banded together in guilds to control quality and prices of castings, these men developed larger castings than ever before because of the need for tremendous cathedral bells, and in so doing invented the strickle board, sweep molding and pit molding, methods still in use today. In Moscow, one great bell was cast weighing 220 tons. Cast from metals confiscated from the people of Moscow, the great bell was made up of such a conglomeration of metals it cracked before sounding a single note.

The first gun was cast in bronze in the 14th century by a Belgian monk. The first cannon projectiles were darts, then concrete balls, iron shot and cannon balls. Separate core manufacture and the use of chaplets stemmed from early gunfounding.

In the 15th century, the foundry industry contributed movable and cast lead type to what is generally

regarded as the greatest single contribution to civilization since fire and the wheel—the printing press. The world's culture also owes a great debt to the foundry for its precious metal jewelry and classical art expressed in metals.

From 1300 to 1700 A.D. all castings were made from direct blast furnace metal. Ore was obtained from bogs and calcined in preparation for reduction. Whereas earlier furnaces produced solid blooms of iron, now molten iron was produced by means of higher furnace shells and water-driven bellows. Among the castings produced in this manner were iron pipes (1455 A.D.), stove plates and iron firebacks (1490) and iron grave markers (1450).

Out of the great demand for these firebacks the patternmaking industry was born. Individual woodcuts bearing elaborate designs were bolted to a board and molds were made from them. Thus for the first time castings were made with uniform depth and detail. Ultimately, metal patterns were developed to replace wood, which wore down too fast.

The first recognized use of coal for foundry purposes took place in England in 1619 and about a hundred years later coke was first used for melting. The hotter temperatures produced by coke enabled foundrymen to turn their attention to bettering the quality of metals for casting. Thus, a contemporary foundryman from France, Rene Antoine de Reaumur became the world's first metallurgical chemist. De Reaumur built a small, separate furnace for remelting pig iron, the forerunner of the modern cupola, and developed the first malleable iron—the "European whiteheart" of today.

The first cupola similar to those of today was built by John Wilkinson, an English foundryman, in 1794, and used the then newly-invented Watt steam engine to provide blast. At about this same period, the foundry flask was invented and chilled iron was produced for the first time. Cast iron had now come of age as a basic material for industry.

The foundry industry moved westward as the New World developed. Colonial founders joined the Revolutionary cause and supported it with money, guns and shot, and six signed the Declaration of Independence.

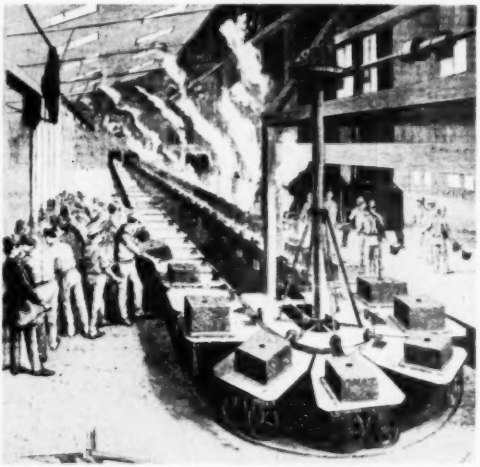
During the 19th century, foundry practice and methods advanced rapidly in Europe and the Americas. Early chemists produced ferrosilicon and noted the influence of carbon and sulphur. Wilkinson's cupola was used more and more widely and the breach between smelting and melting became greater. In 1850 an unknown New England inventor devised the drop bottom. By 1874 the first commercial cupola in the United States was introduced.

A distinctly American development of the period was the chilled car wheel, on which a basic patent was obtained in 1847. While gray iron was developing, the "American blackheart" malleable industry was born when Seth Boyden started experimenting in 1820.

Steel was later in developing on an industrial basis and followed the 18th century discoveries of Hunstman in England, Bergman in Sweden and Mushet in Scotland. Steel casting output slowly increased as advances were made in England, Germany, Austria and the United States. Melting was by crucible until Kelly, and five years later Bessemer, devised the converter. In 1866 they joined forces.

Though developed earlier, the great initial cost of the open hearth prevented its adoption in the United States until 1870. By 1878 the electric arc furnace had been devised. Induction furnaces were introduced from Sweden in 1930.

Along with improvements in melting equipment in the 19th century came progress in molding, coremaking, sand conditioning and materials handling, all presaging the tremendous mechanization of the industry which is still going on today. Metallography was started when Sorby, after whom the microconstituent sorbite was named, polished, etched and examined microscopically metal surfaces in England in 1863.



Nineteenth Century foundry mechanization.

History of molding machines goes back to 1800 in England but the first dependable molding machine, a jolter, was put on the market in 1837. The stripping machine came out in 1880. Modern permanent mold casting, centrifugal casting, slush casting, and a die-casting procedure were developed during the 1800's.

The year 1890 saw the first mold conveyor installed. Consisting of pallets mounted on wheels, the conveyor was motor driven and continuous, and integrated molding, pouring and cooling operations. Mechanized cleaning of castings became a reality with the development of the tumble, in the 1880's. The sandblast first appeared in 1870 but was not used extensively until about 1900.

Written to cover a blind spot in the history of the foundry industry according to author Bruce L. Simpson, DEVELOPMENT OF THE METAL CASTINGS INDUSTRY ends with the start of the 20th century, the beginning of modern foundry practice. Developments of the past 50 years are well documented in such publications as those of the American Foundrymen's Society, and the Institute of British Foundrymen, he points out in the conclusion of DEVELOPMENT OF THE METAL CASTINGS INDUSTRY.

COMPLETE PROGRAMS FOR TWO REGIONAL MEETS

Birmingham

OLDEST OF A.F.S. REGIONAL CONFERENCES, the 17th Annual Foundry Practice Conference of the Birmingham District Chapter, to be held at the Tutwiler hotel, Birmingham, February 17-19, will feature extensive plant visitations, two-day technical sessions and an annual banquet. A.F.S. National President W. B. Wallis will be the featured speaker at the luncheon on February 17, and Dr. John M. Gallalee, president of the University of Alabama will address the banquet.

Technical sessions of the conference are scheduled to cover such varied foundry subjects as nodular graphite cast irons, time studies, core baking, gating systems and casting defects. Papers will be delivered by nationally-known authorities on each subject.

Thursday, February 17

9:00 a.m.—REGISTRATION. Tutwiler hotel, Birmingham.

10:30 a.m.—*"Nodular Graphite Cast Irons,"* C. K. Donoho, American Cast Iron Pipe Co., Birmingham.

12:30 a.m.—LUNCHEON. Speaker: A.F.S. National President W. B. Wallis.

2:30 p.m.—*"Time and Motion Study in the Foundry."*

4:00 p.m.—*"Dielectric Core Baking,"* J. W. Cable, consultant, Thermex Div., Girdler Corp., Louisville, Ky.

8:00 p.m.—ENTERTAINMENT. Chairman: D. C. McMahen, Harbison-Walker Refractories Co.

Friday, February 18

9:00 a.m.—PLANT VISITATIONS. Chairman: F. S. Middleton, Jackson Industries, Inc.

2:00 p.m.—*"Gating Systems for Castings."* Motion picture and talk by W. H. Johnson, U. S. Naval Research Laboratory.

3:30 p.m.—*"Relationship Between Casting Defects and Elevated Temperature Sand Properties."* Motion picture and talk by Harry W. Dietert, Harry W. Dietert Co., Detroit.

7:00 p.m.—ANNUAL BANQUET. Speaker: Dr. John M. Gallalee, president, University of Alabama.

Saturday, February 19

The entire day will be devoted to plant visitations. Plants open for inspection are:

Alabama By-Products Corp., Alabama Clay Products Co., Alabama Foundry Co., American Brake Shoe Co. (Southern Wheel Division), American Cast Iron Pipe Co., Anderson Brass Works, Inc., W. J. Bullock Co., Caldwell Foundry & Machine Co., Continental Gin Co., Dimick Casting Co., East Birmingham Bronze Co., Foundry Service Co., Goslin Birmingham Mfg. Co., The Hill & Griffith Co., McWane Cast Iron Pipe Co., Harbison-Walker Refractories Co., Jackson Industries (Foundry Division), Jefferson Foundry Co., Miller Foundry Co., National Cast Iron Pipe Co., Pressure Cast Products Corp., Sloss-Sheffield Steel & Iron Co., Stockham Pipe Fitting Co., Southern Precision Pattern Works, Thomas Foundries, Inc., Unit Stove & Furnace Co., and Woodward Iron Co.

Officers and committee chairmen of the Birmingham District chapter, hosts to the conference are:

Chairman, Dr. J. T. MacKenzie, American Cast Iron Pipe Co.; *vice-chairman,* C. P. Caldwell, Caldwell Foundry & Machine Co.,; *secretary-treasurer,* Fred K. Brown, Adams, Rowe & Norman, Inc.

Committee chairmen are: *Publicity,* J. P. McClendon, Stockham Pipe Fittings Co.; *Program,* C. P. Caldwell, Caldwell Foundry & Machine Co., and S. F. Carter, American Cast Iron Pipe Co.; *Plant Visitations,* F. S. Middleton, Jackson Industries, Inc.; *Entertainment,* D. C. McMahen, Harbison-Walker Refractories Co.; *Membership,* D. C. Abbott, Hill & Griffith Co.; *Educational,* E. A. Thomas, Thomas Foundries Co.; *Registration,* Morris H. Benners, T. H. Benners & Co.

Wisconsin

Thursday, February 10

9:00 a.m.—REGISTRATION. Fourth Floor, Schroeder Hotel.

10:00 a.m.—OPENING ADDRESS: Dean M. O. Withey, College of Engineering, University of Wisconsin. A.F.S. National President W. B. Wallis will speak on activities, policies and aims.

12:00 noon—LUNCHEON. Speaker: Frank G. Steinebach, Penton Publishing Co., Cleveland.

2:00 p.m.—SECTIONAL MEETINGS

Steel—*"What Do We Know About Sand"?,* J. B. Caine, Sawbrook Steel Castings Co., Lockland, Ohio.

Gray Iron—*"Core Baking,"* W. Harvey Payne, W. Harvey Payne Co., Chicago.

Malleable Iron—*"Malleable Core Practice,"* Eric Welander, Deere & Co., Moline, Ill.

Non-Ferrous—*"Cement Molding in the Non-Ferrous Foundry,"* Charles E. Schley, Philadelphia.

Pattern—*"What a Foundryman Expects of Pattern Equipment,"* Walter A. Balton, Link-Belt Co.

Technical—*"Basic Principles Common to Foundry Melting Practice,"* Prof. P. C. Rosenthal, University of Wisconsin.

3:40 p.m.—SECTIONAL MEETINGS

Steel—*"Theoretical Approach to Riser Dimensioning,"* Charles E. Locke, Armour Research Foundation, Chicago.

Gray Iron—*"Sand, Metal or Men—Causes of Scrap,"* Harry E. Gravlin, Ford Motor Co., Dearborn, Mich.

Malleable Iron—*"Sand Reclamation,"* Earl Woodliff, Foundry Sand Service Engineering Co., Detroit.

Non-Ferrous—*"Sound Aluminum Castings,"* B. D. Claffey, Acme Aluminum Alloys, Inc., Dayton, Ohio.

Pattern—*"Specialized Production Patterns,"* Frank M. Kulke, Motor Castings Co., Milwaukee.

Technical—*"What is Strength?"* J. B. Caine, Sawbrook Steel Castings Co., Lockland, Ohio.

6:30 p.m.—ANNUAL BANQUET. Speaker: Dr. J. M. Klotsche, president, Wisconsin State Teachers' College—*"The Destiny That is Ours."*

Friday, February 11

10:00 a.m.—SECTIONAL MEETINGS.

Steel—*"Reproduceability of Mechanical Tests,"* Dr. H. A. Schwartz, National Malleable & Steel Castings Co., Cleveland.

Gray Iron—*"Statistical Quality Control in the Foundry,"* Speaker to be announced.

Malleable Iron—*"Grinding Problems."*

Non-Ferrous and Pattern—Joint Meeting.—*"Permanent Molds,"* S. Sandlin.

Technical—*"Color Photography and Polarized Light in Metallography."* Charles S. Foster, Eastman Kodak Co.

12:00 noon.—LUNCHEON MEETING. Speaker: Arthur L. Grede, Grede Foundries, Inc., Milwaukee. *"Impressions of My European Trip."*

2:30 p.m.—SECTIONAL MEETINGS.

Steel—*"Improving the Quality of Steel Castings to Offset Substitute Materials,"* William J. Phillips, Steel Founders' Society of America, Cleveland.

Gray Iron—*"Cupola Operation and Fuel Problems,"* B. P. Mulcahy, Fuel Research Laboratory, Inc., Indianapolis.

Malleable Iron—*"Recent Developments in Malleable Iron,"* Richard W. Heine, University of Wisconsin.

Non-Ferrous—*"Information Please"* discussion of foundry problems. Speakers panel: A. K. Higgins, Jr., Allis-Chalmers Mfg. Co., Milwaukee; L. M. Jessop, Federated Metals Co., New York; Wm. M. Ball, R. Lavin & Sons, Inc., Chicago; and George W. Anselman, Woodruff & Edwards, Inc., Elgin, Ill.

Pattern—*"Symposium on Plastic Pattern Equipment."* Panel: A. F. Pfeiffer, Allis-Chalmers Mfg. Co., Milwaukee; Martin Rintz, Continental Foundry & Machine Co., East Chicago, Ind.; Steve Denkinger, Jr., Atlas Pattern Works, Milwaukee.

Technical—*"New Tests for Molding Sand,"* Prof. C. C. Sigerfoos, Michigan State College, East Lansing, Mich.

Dues Proration . . .

EASES CHAPTER MEMBERSHIP CHAIRMAN LOAD
REDUCES A. F. S. NATIONAL OFFICE EXPENSE

DECREASED NATIONAL OFFICE EXPENSE and considerably less work for chapter membership chairmen are expected to follow proration of A.F.S. annual dues. Discussed fully at the 1948 Chapter Chairman Conference, the plan was approved, worked out, and became effective January 1, at the same time as the new dues schedule announced in the November issue of AMERICAN FOUNDRYMAN. New dues are shown in the New A.F.S. Dues Structure table.

Requiring all of 1949 to put into effect, proration of annual A.F.S. dues provides for expiration of membership of an entire chapter on the same date. This enables chapter membership chairmen to do most of their work in the two or three month period preceding the chapter's permanent renewal date.

In the National Office, billing and any other business details related to the Society's membership dues can be handled on a chapter basis under the new scheme. This is not possible now because some memberships in all chapters are renewable at the beginning of each month.

Approximately 60 per cent of all A.F.S. memberships are due to expire on June 30 at present. This calls for a greatly increased office staff during the summer months. Under the new plan no memberships will expire in June or July, eliminating the present heavy summer load in the National Office and minimizing the work of chapter membership chairmen during much of the traditional vacation period. Clerical routine will be equalized, assuring consistently satisfactory service for A.F.S. members. At the end of each of the remaining ten months, all memberships in specified chapters will expire. Excluding student chapters, and non-chapter and foreign members, the remaining memberships have been arranged so that approximately the same number of renewals will occur in each month with the exception of June and July.

Chapters and the months memberships expire under the new plan are shown in the Chapter Membership Renewal Chart. Also shown is the number of months' dues to be invoiced during 1949 for any current expiration date so that thereafter all memberships in any chapter will become renewable on the same date.

How dues proration works for various chapters is shown in the following examples:

1. Membership of "A" of the Wisconsin Chapter was due to expire on December 31, 1948. Effective December 31, 1949, *all* Wisconsin Chapter memberships are scheduled to expire. "A" was billed as of January 1, 1948, for 12 months' dues.

2. "B," a member of the Central Indiana Chapter, is paid up to July 31. New chapter renewal period starts February 1 (all memberships to expire January 31). As of August 1, 1949, "B" will be billed for six months to bring him to February 1, 1950. As of that date and each year thereafter he will be billed, along with all other chapter members, for 12 months' dues.

3. "C" is a member of the Toledo Chapter and his membership will expire June 30. The renewal date for the entire chapter is October 1. As of July 1, "C"

CHAPTER MEMBERSHIP RENEWAL CHART 1949-50

Dates on which your memberships now **EXPIRE**. See your membership card.

Dec. 31	Jan. 31	Feb. 28	Mar. 31	Apr. 30	May 31	June 30	July 31	Aug. 31	Sept. 30	Oct. 31	Nov. 30

Chapter	Dates on which memberships within Chapters shown will henceforth **EXPIRE** after 1949.	Number of months' dues to be invoiced during 1949 so that all memberships in any Chapter hereafter will become renewable on the same date.											
Canton Oregon Tri-State Wisconsin	**DECEMBER 31**	12	11	10	9	8	7	6	5	4	3	2	1
Birmingham Central Indiana Central Michigan Eastern New York Tennessee	**JANUARY 31**	1	12	11	10	9	8	7	6	5	4	3	2
Chesapeake Northeastern Ohio Northwestern Pennsylvania Timberline	**FEBRUARY 28**	2	1	12	11	10	9	8	7	6	5	4	3
Central Illinois Metropolitan Saginaw Valley Texas	**MARCH 31**	3	2	1	12	11	10	9	8	7	6	5	4
British Columbia Northern California Philadelphia	**APRIL 30**	4	3	2	1	12	11	10	9	8	7	6	5
Chicago No. Illinois-So. Wisconsin Washington	**MAY 31**	5	4	3	2	1	12	11	10	9	8	7	6
None	**JUNE 30**												
None	**JULY 31**												
Central Ohio Cincinnati Michiana Western New York	**AUGUST 31**	8	7	6	5	4	3	2	1	12	11	10	9
St. Louis Southern California Toledo Western Michigan	**SEPTEMBER 30**	9	8	7	6	5	4	3	2	1	12	11	10
Central New York Detroit Mexico City Quad City	**OCTOBER 31**	10	9	8	7	6	5	4	3	2	1	12	11
Eastern Canada & Newfoundland Ontario Rochester Twin City	**NOVEMBER 30**	11	10	9	8	7	6	5	4	3	2	1	12

New A.F.S. Dues Structure

For financing a program of expanded service to the industry, the A.F.S. Board of Directors has approved the following revised dues structure, effective January 1, 1949.

Class of Membership	Current Rates	Dues on Jan. 1, 1949
SUSTAINING	$100.00 min.	$150.00 min.
For firms desiring to aid the Society's activities in more direct proportion to the benefits received.		
COMPANY	$50.00 annual	$65.00 annual
Separate Company membership required for each separate plant of any one organization.		
PERSONAL	$15.00 annual	$20.00 annual
For individuals not connected with Sustaining or Company member plants.		
Exception No. 1—Individuals connected with plants holding Company or Sustaining membership.	$8.00 annual	$10.00 annual
Exception No. 2—Individuals engaged solely in educational or domestic government work.	$8.00 annual	$10.00 annual
STUDENT OR APPRENTICE	$4.00 annual	$ 4.00 annual
Application for Student or Apprentice membership must be signed or verified by Instructor or Supervisor.		

will be billed for three months, and billed again as of October 1 for a full year's dues.

Billing for three, two, and one months' dues will be made to avoid billing for more than a full year's dues. It is hoped, however, that members involved in these short billing periods will voluntarily pay more than a full year's dues thus eliminating a second billing one, two, or three months later.

During 1949, in effecting the change over in dues renewal, billing will be exact and there will be many odd amounts such as $5.83, $16.67, $27.08, $59.58, etc. This is in accord with the wishes of those attending the Chapter Chairman Conference in June, 1948.

The new plan involves no change in the present procedure whereby dues invoices are mailed 30 days in advance of the renewal date, final notices mailed 30 days after the renewal date, and members dropped for non-payment 60 days after renewal date. Thus, during 1949, the period for renewal of any membership will revolve around the *present renewal date*—not the new permanent uniform renewal date which will be in effect after dues proration has been completed at the end of 1949.

Install Sixth A.F.S. Student Chapter At University of Illinois, Urbana

PRESENTATION OF THE CAST IRON RATTLE, signifying official acceptance into the American Foundrymen's Society, marked the installation of the University of Illinois Student Chapter at a ceremony held October 22 at Gregory Hall, on the University of Illinois campus, Urbana. More than 75 faculty members, students and foundrymen attended.

Charles E. Drury, chairman of the student chapter introduced Dean H. H. Jordan of the University's engineering department, and Prof. N. A. Parker, head of the mechanical engineering department, who welcomed the student chapter on behalf of the University.

Visiting foundrymen were introduced by Chairman Drury, and each pledged his cooperation and assistance and that of his company.

A.F.S. National Secretary-Treasurer Wm. W. Maloney spoke on the past, present and future of A.F.S., and outlined the Society's principles. Upon conclusion, he presented Chairman Drury with the cast iron rattle. A.F.S. National Secretary Emeritus R. E. Kennedy, a member of the engineering faculty of the University's Navy Pier Branch, Chicago, spoke a few words of welcome to the new student chapter members.

F. W. Shipley, A. V. Anderson and B. L. Bevis of the Caterpillar Tractor Co., Peoria, each spoke on the problems and requirements of his particular type of foundry work for the benefit of the student members.

James Leach **Charles Drury**

Prof. James Leach, faculty advisor, thanked the visitors on behalf of the student chapter.

Those attending the ceremony from out of town were A.F.S. National Director J. E. Kolb, F. W. Shipley, chairman of the Central Illinois Chapter of A.F.S., Messrs. Bevis, Anderson and Smith, all of Caterpillar Tractor Co., Peoria; Clinton B. Soper, the student chapter's industrial advisor, American Foundry & Furnace Co., Bloomington; Fred Carl, Central Foundry Division, GMC., Danville, Ill.; A. V. Martens, Pekin Foundry, Pekin, Ill.; E. J. Burns, Illini Foundry Co., Peoria, and Secretary Emeritus Kennedy.

Ohio Regional Foundry Conference To Discuss Foundry Developments

"NEW DEVELOPMENTS for the operating foundryman" will be the theme of the Second Ohio Regional Foundry Conference, to be held March 11 and 12 in Columbus. The conference will be sponsored jointly by the five A.F.S. chapters in Ohio, and by Ohio State University as part of its 75th Anniversary celebration.

The conference will consist of four technical sessions covering gray iron, steel, malleable and non-ferrous founding developments, and a session on design.

The Foundry Educational Foundation will present a program at the March 12 luncheon. The Ohio State University A.F.S. Student Chapter will be active in arranging accomodations for visitors, and in facilitating conference presentations.

Foundrymen, students and faculty members from Ohio are urged to attend. The complete program will appear soon in AMERICAN FOUNDRYMAN.

QUALITY CONTROL REVIEW...

Summarize Test Procedures for Steel Foundrymen

John W. Juppenlatz
Chief Metallurgist
Lebanon Steel Foundry
Lebanon, Penn.

Five papers, sponsored by the Annual Lecture Committee of A.F.S., were presented at Lecture Course Sessions of the 52nd Annual A.F.S. Meeting at Philadelphia, May 3-7, 1948. In this issue, test procedures for quality control in the steel foundry are described. Other papers in the series—gray iron, brass and bronze, aluminum and magnesium, malleable iron—will appear in future issues.

QUALITY CONTROL when applied to steel castings means that the character and over-all properties are consistently and uniformly maintained from casting to casting, according to predetermined standards. Controlled quality must be processed into the castings, since it cannot be produced by inspection means alone.

Three of the most vital phases of steel foundry operation are: (1) uniformity of raw materials; (2) exacting process controls for manufacture; (3) inspection for the standard of quality required. Each of these has a definite effect on the quality of steel castings and the cost of their production.

Many workers today are limited in skill, finding it difficult to adjust procedures with a change in class of work, different basic materials and other variables often found in the normal steel foundry. Supervision and careful instruction then are essential as to the procedure to be employed, and basic materials should be maintained at uniform levels so that further adjustment of process controls is unnecessary. Deviation from well-established procedure is definitely undesirable and usually results in an unsatisfactory product. Rigid controls of all operations, process procedures, and raw materials are needed in order to produce steel castings of the proper quality with a minimum of scrap.

It would be impossible in the scope of this paper to include all of the detailed test methods of control procedure, either process or quality, but an effort will be made to review some of the methods employed for the purpose of stimulating thought toward other methods and discussion on the subject.

Since the quality level of the many types of steel castings varies considerably, the specification requirements must be thoroughly understood as well as mutually agreed upon. Specifications, often including processing requirements, are subject to fluctuation, usually becoming more severe with changing standards and improvement of inspection methods. These requirements, with predetermined standards of acceptance, should be established for each class and grade of casting.

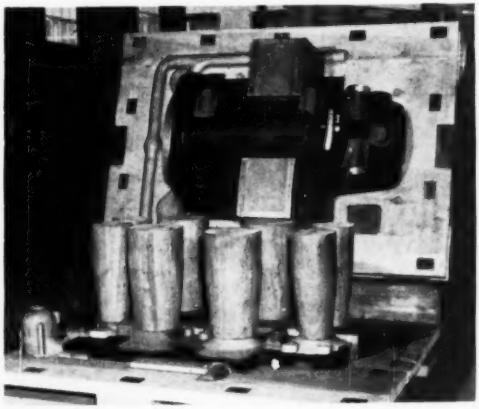
High quality castings begin during the early stages of design. Close collaboration between the designer and the steel foundryman is vitally important, but too often neglected. Good, practical designs, which permit the steel foundryman to carefully plan his production methods, with directional solidification possibilities built into the design, are essential for highest quality. It is not possible, for example, to feed metal from thin sections to thick sections, since the thinner section freezes early, while the heavy section is still molten.

Directional solidification involves controlling the rate of solidification so that freezing will normally occur at the thinnest cross section and gradually progress from that point toward the heaviest cross section involved, which then may be adequately fed with hot metal from a suitably placed riser. With the tapering and blending of wall sections built into the original design, sounder castings with freedom from internal shrinkage can be produced.

Other methods of indirectly controlling directional solidification are available, such as the differential thermal gradients resulting from the planning of heading and gating, effective chilling of areas or padding (tapering) of sections which must be removed (Fig. 1).

Designs with restraint should be avoided, as these often result in hot tears. Blending or streamlining heavy sections into lighter sections is always desirable, as well as avoidance of abrupt angles with inadequate fillets. Proper designs always afford the foundryman the opportunity to adequately feed the casting for freedom from internal shrinkage. Good quality castings cannot be produced from every design. Many complex or "impossible" steel casting designs can best be produced with two or more castings welded into a unit.

Fig. 1—Pattern equipment used for pump case casting. Cope and drag pattern boards are shown with heading and gating carefully planned for a casting to meet radiographic standards for internal soundness. Note padding under risers for directional solidification.



Properly made pattern equipment is as important as design. From this point on, the quality of the casting remains in the hands and head of the steel foundryman. He must carefully plan his methods of heading, gating, molding and pouring. The most preferred method of heading and gating is to incorporate these essential parts of the rough casting on the pattern equipment, usually mounted integrally on a board (Fig. 1). This step leaves little to the individual molder's judgment and insures duplication of the methods on subsequent castings once good practice has been established.

Pilot castings should be proved before production runs are attempted. This procedure aids in disclosing the proper manipulation of cores and molds, dimensional requirements of the casting, and affords an opportunity to survey soundness and effectiveness of risering and gating with a margin of safety needed for normal variations of items under other process control measures.

Pattern equipment must receive intermittent checking and repair since wear, warpage and normal usage can easily cause dimensional inaccuracy in the castings. This periodic check should occur at set intervals, according to experience with the dimensional accuracy of the castings. This procedure of pattern checking against current castings will reveal conditions of wear, forewarning of the time when a replacement pattern will be necessary to prevent a loss due to the scrapping of many castings.

Test Raw Materials

The phases concerning specifications, designs, planning of steel foundry technique, pilot castings, inspection and quality standards of acceptance have been indicated briefly. With these major phases established and understood, repetition of procedure is essential in order to produce steel castings of equivalent qualities. Quality control test procedures are therefore necessary aids to maintain uniform raw material supply, proper processing and final testing to prove the product.

The steel foundry purchases large quantities of raw materials, all of which are converted, usually indirectly, into steel castings. These raw materials represent a large percentage of the cost of manufacture of steel castings, so the choice of raw materials must be proper and conform to rigid specifications and uniformity. Incoming raw materials should be tested to ascertain that uniform quality is maintained with a minimum of fluctuation.

Some raw material shipments are not entirely uniform, with the result that disruption may occur in the line of operation, causing losses in the preparation of casting components, or even the casting itself. With controlled processes, it is not likely the use of nonuniform or inferior raw materials will continue unnoticed, since they will soon be indicated by other process control tests.

It would be impossible to cover test procedures for qualities of all purchased steel foundry commodities. Steel scrap and sand are obviously major cost items. Their control to specification requirements and test procedures to ascertain compliance are vital.

Steel Scrap: Requirements for steel scrap will vary according to the melting process employed; that is, whether acid or basic practice, and size or type of furnace. Test procedures are indicated in Table 1.

TABLE 1—TEST PROCEDURES FOR STEEL SCRAP

Requirement	Test Procedure
A. Composition of normal elements C, Mn, Si, P and S.	Chemical analysis or spectroscope
B. Presence of alloying elements Cr, Ni, Mo, Cu, V, W.	Chemical analysis or spectroscope
C. Presence of tin, antimony and white metals, etc.	Chemical analysis or spectroscope, or by visual inspection of individual sorting procedure.
D. Relative size, weight or mass	Weight per cu. ft. or visual inspection by estimation
E. Freedom from contamination	
1. Oil, paint, coatings and electroplating	Visual
2. Excessive rust and scale	Visual
3. Inclusion of coke, coal and other foreign materials	Visual

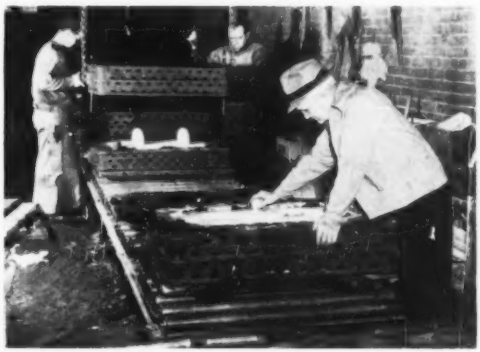


Fig. 2—Checking uniformity of ramming of a green sand mold with a mold hardness gage just after the pattern was drawn and before air drying had started.

The importance of the requirements set forth in Table 1 is not to be underestimated. Proper grading and segregation are vital for best operations. Items *A* and *B* are generally well understood and the test procedure indicated. Items *C* and *E* are definite scrap quality factors, but are often neglected when scrap inspection is made. The steel scrap situation today is not good, and may not improve for years to come with respect to contamination by extraneous alloys that are not eliminated by melting operations. It is therefore necessary that the conditions of items *C* and *E* be recognized when certain metallurgical qualities are desired; otherwise controlled melting procedure may be adversely affected along with product qualities.

Sand and Binders: Sand and binders are raw materials used in large quantities for the production of steel castings, and constitute a large part of production expense. Much attention has been directed by individuals and A.F.S. Sand Committees toward the formulation of test procedures for molding and core sands in steel foundry operation. The specifications for raw refractory materials must be prepared with proper care, and flexible test procedures applied to ascertain the uniformity of the product that will yield

TABLE 2—RAW SAND INSPECTION

Requirement	Test Procedure*
A. Grain fineness	A.F.S. Screen test
B. Grain distribution	A.F.S. Screen test
C. Clay content	A.F.S. Sand washer
D. Freedom from extraneous material	Low-power magnification

*A.F.S. FOUNDRY SAND TESTING HANDBOOK

consistent properties when properly blended and mixed by fixed formulas for molding and coremaking operations. Requirements and tests for raw sand inspection are shown in Table 2.

Of course, other acceptance tests may be employed since types of raw sand for steel foundry use vary according to locality of production. The character of the grain may vary from rounded to subangular, or even crushed rock. These factors, as well as many others such as sintering points, are covered by the A.F.S. FOUNDRY SAND TESTING HANDBOOK and should be carefully considered when selecting sources of supply.

The clay content of washed silica sand is low in most cases. Under Item *C* of Table 2, the clay content is indicated as an important factor. The presence of more or less clay in the raw sand increases or decreases the bonding qualities of fixed sand mixtures. A constant clay value then is desirable so that mixed sand prepared by standard formulas will yield uniform sand qualities without resort to fluctuating changes of formulation or other modification.

Acceptance control tests on sand binders, as raw materials, are not too well established, and the uniformity of these products has rested largely upon the manufacturer. These binders commonly for steel foundry use, may be classified as follows:

1. Clay types: (a) fireclay or kaolin; (b) bentonite (Western Wyoming).

2. Organic types: (a) cereal; (b) oils (core drying types); (c) legnin; (d) resins and gums; (e) proteins and others.

Probably the most informative control acceptance test of the foregoing raw materials is based on the principle of checking the green or dry strengths, or both, under fixed conditions, employing the following principles:

1. Use of a standard grade of washed silica sand with known properties.

2. Under fixed formulas and mixing conditions, prepare testing samples.

3. Test green strength properties by A.F.S. procedures when applicable.

4. Test dry strengths after baking at fixed temperatures and cycles, testing after cooling under a dessicator when applicable, using A.F.S. test procedures.

Other tests may be employed to determine the properties of raw material binders and their uniformity. In the case of clays, the sintering test (A.F.S. FOUNDRY SAND TESTING HANDBOOK) has proved to be of value. The water soluble contents of some of the cereal binders appear to be good indicators of their uniformity and bonding qualities. Simple test procedures adaptable to checking the qualities of sand binders are yet to be devised in some instances.

Silica flour is another refractory material used in large quantities by the steel foundry. The composition can be determined by chemical means, but the most important physical characteristics are the sintering and refractory properties. The fineness of silica flour is indicated by number, such as 200 mesh, which means that 95 per cent will pass through a 200-mesh screen. This is a wet test. The test is quite simple, using a known weight of silica flour on a fine screen such as 325 mesh. The fine material is washed with clear tap water through the screen, which retains the coarser particles. The residue is dried and tested on the U. S. Series Equivalent screens, noting the amounts retained on each screen.

With carefully inspected and approved raw materials, only some of which have been covered, variables of further processing should then be greatly minimized.

Molding and Core Sand Preparation: Blending and mixing of steel foundry molding and core sands must be based upon sound principles, experience and experimental adjustments in order to arrive at proper formulas for the class of work under production. In addition to adequate controls of raw materials, the operation of preparing the mixture must be further controlled:

1. Mechanical maintenance of the mixer.
2. Measurement of all ingredients.
3. Control of dry and wet milling time.
4. Control testing of the mixed product.

The first three items are functions of supervision, clocks or mechanical devices and need no further discussion. Tests under Item 4 should be made at frequent intervals to insure that the product is under control. These tests are covered by the A.F.S. FOUNDRY SAND TESTING HANDBOOK, and are as follows:

1. Moisture.
2. Green strength.
3. Green permeability.
4. Flowability.
5. Dry strength.
6. Dry permeability.

Other tests such as hot strength, hot collapsibility, expansion, hot shock and others, disclose variations of mixture properties, but are not considered as routine

Fig. 3—Gaging unit cores prior to setting in molds.

requirements for normal control. The sand mixtures, prepared as indicated, should be properly handled and stored for use and under no circumstances should be allowed to "dry out" or deteriorate before use.

Molds and Cores. The construction of the mold should be based on the proper principles, with the use of the correct grade of prepared sand mixture. Obviously, supervision and pride of mold and core operations contribute greatly toward the quality of the product. Ramming should be such that the molds possess ample firmness to withstand the cutting, scouring and abrasion action of molten metal and also the pressure which, in a soft-rammed mold, may result in a swelled casting.

Excessive ramming may result in defects such as scabs or blows. In order to control and maintain proper ramming conditions, an effective means is found in the use of a mold hardness gage, which indicates the relative hardness expressed in figures. This check operation can be performed by an inspector or supervisor just after the patterns have been withdrawn and before air drying has started (Fig. 2).

Production of cores requires precautions similar to those described under molding. Sand mixtures usually differ in character, ranging from that which possesses early collapsibility to one with high hot hardness strengths for heavy work. The use of the proper mixture for the specific core is necessary, and since many mixtures may have similar appearances, organic dyes are often utilized for quick identification. Use of improper grades of core sand may result in defective castings or difficult cleaning.

Enforce Procedures

Construction of rod supports, mechanical rigidity, as well as firmly rammed cores with adequate venting are important phases of duplication after the proper procedure has been established. Enforcement of construction procedures rests with supervision or checkers for that purpose. Core hardness tests are of value for control, as in the molding operation.

The majority of steel foundry cores is baked. Cycles of baking, temperatures, and time at temperature vary with the mixtures employed and type of core in production. Baking procedures do not necessarily require discussion, but good oven equipment, with uniform heat conditions, and records of heating cycles should be checked periodically in order to produce cores of uniform qualities.

Many cores after baking require assembly. This may be a simple matter of joining two halves together, or a more complex arrangement. This operation may result in a product which is off dimensionally. Eccentric cores, shifts and other defects are often noticeable. Gaging of cores upon assembly with go and no-go gages is a requirement for highest dimensional stability. A simple gaging test is shown in Fig. 3. Cores should also receive further inspection to determine cleanliness, freedom from core and mold wash sags or runs, and any other objectionable features before being set in the molds.

Setting of cores into molds and preparation of molds for closing is an operation which requires skill and care. Of course, properly made cores and molds may be improperly assembled, such as misalignment with the provided core prints, thus causing dimentional inaccuracies. Intricate molds and core set-ups often require accurate checking with gages and other means in order to assure castings with proper dimensional tolerances, alignment, and wall thickness (Fig. 4). The molds, after proper assembly, are ready for pouring, but should receive protection from foreign materials becoming lodged at the bottoms of riser openings.

TABLE 3—SLAG CONTROL

Test	Indicator
Acid Practice	
(a) Viscosity	Acidity and FeO content
(b) Color pancake test—water cooled	Acidity and FeO content
Basic Practice	
(c) Color test—water cooled	Lime-silica ratio—FeO content
(d) Color pancake test in metal mold—air cooled	Lime-silica ratio—FeO content
(e) Viscosity (before additions of fluorspar)	Lime-silica ratio

Melting Controls: Molten steel supplied for casting purposes must be (a) proper composition, (b) well killed without tendency toward porosity, and (c) at a temperature sufficient to promote the required fluidity. These three phases of control will be covered with flexible test procedures, endeavoring to avoid melting techniques or complex interpretation, which are adequately covered by *Electric Furnace Steel Proceedings*, vol. 1-6; AIME *Open Hearth Proceedings;* and *Metallurgy of Steel Castings*, C. W. Briggs.

Fig. 4—Checking core alignment of multiple core assemblies used in casting of intricate pump casings.

Raw materials (scrap, etc.) in the charge must be under control, as discussed under raw materials, and capable of yielding compositions desired in the final product. Many elements such as nickel, molybdenum, copper, tin and others are not oxidizable by the acid or basic practice; sulphur and phosphorus are not reduced by the acid practice. The charge must be prepared with selected scrap within allowable limits of the composition desired.

With either the acid or basic process, oxidization of the metal is essential for the production of steel for casting purposes. The degree of oxidization is impor-

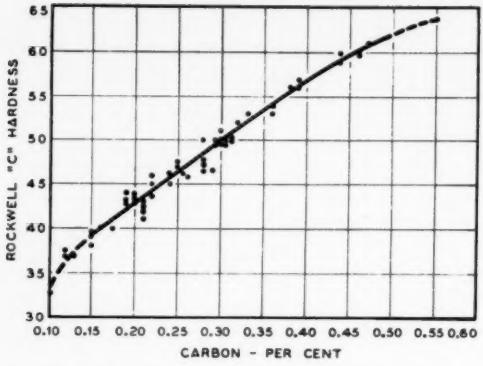


Fig. 5—Carbon Content vs. As-Quenched Hardness. (From K. L. Clark and N. Kowall, Electric Furnace Steel Proceedings, AIME, vol. 2, 1944, p. 663.)

tant, avoiding excesses or deficiencies. Oxidization of the metal in the bath must be estimated in many instances before a laboratory analysis is returned, so the melter relies upon slag tests and other methods to indicate the degree of oxidization at that time. The control of slag has become an important phase of melting procedure in both acid and basic furnaces during oxidizing and refining periods. Some of these tests are shown in Table 3 in the order of relative use.

Further details of slag control can be found in the foregoing references, but have been given in brief form (Table 3) to show that slag tests are of distinct value in obtaining more uniform furnace processing with a more consistent product within specification limits, chemically and physically.

Chemical laboratory tests for preliminary control of elements are desirable whenever time permits. Acid electric furnaces operate on fast-melting cycles, and often time does not permit determination of elements to aid the melter. Slag controls are of unquestionable value for composition control, but other tests are needed—estimations which can be quickly made on the melting floor. Three methods of carbon estimation are: (1) fracture test; (2) magnetic methods; (3) hardness test.

The fracture test is quite old, and is an excellent method for rapid carbon estimation by skilled furnace men. A test sample is poured in a rectangular chill mold, removed and chilled in water. Carbon is estimated by visual examination of the fracture. After being broken the fracture is visually examined, a larger crystal size indicating lower carbons. Silicon content may also be estimated.

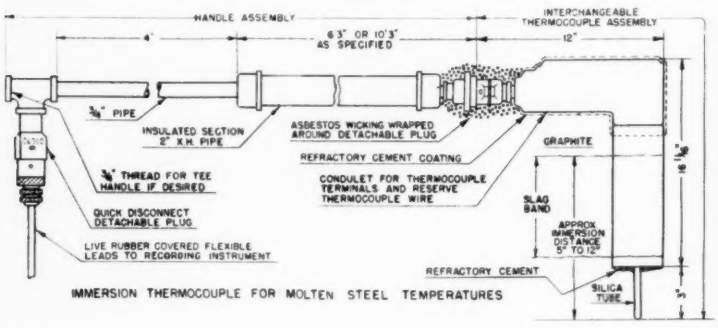
Magnetic methods (*Electric Furnace Steel Proceedings*, vol. 2, 1944, pp. 169-176) can be employed for estimation of carbon with the principle of coercive force as the criterion for the carbon content. A metal mold receives the sample of molten steel (deoxidized with aluminum). After stripping from the mold and cooling, a sample of definite size is obtained. This is inserted in the coil of a special electrical instrument, and the magnetic qualities indicated are transposed to carbon content. The sample must be sound and of proper size. Excessive amounts of alloys will result in erroneous findings.

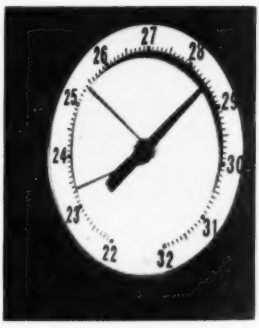
Hardness tests, either Rockwell C or Brinell, have been used for carbon estimation. The test sample is cast from deoxidized metal into a small metal mold. The specimen is stripped from the mold and quenched if still above hardening temperature. Some operators reheat the sample to hardening temperatures and quench. Flat surfaces are prepared for hardness readings, which are converted into carbon content (Fig. 5). This method is described by K. L. Clark (*Electric Furnace Steel Proceedings*, vol. 2, 1944, p. 161).

Chemical analysis controls, or spectrographic controls when applicable, are accepted means of testing the final metal compositions, or can be employed for preliminary work when time permits. Actual figures are always better than estimates.

When bath composition has been established, deoxidization is the next control step. A well-killed steel which shrinks properly and is free from pinhole porosity when made into castings is desirable. "Set" tests taken before tapping indicates this condition and the ability of the steel to shrink in a normal manner. Green sand cups are prepared and used while still moist to simulate green sand mold conditions. If the metal remains quiet and dishes properly on the upper face, it is considered to be sound for casting purposes. If it rises, porosity is indicated, which may be cause

Fig. 6—Drawing of immersion thermocouple unit, and the temperature recorder. (G. Vennerholm and L. G. Tate, American Foundryman, May, 1947, p. 56, "Determination of Molten Metal Temperatures.")





for reworking the heat. Other types of "set" tests are employed to disclose tendencies toward porosity.

Proper fluidity of the molten steel is needed in order to successfully fill the molds. When metal has been processed under proper oxidizing conditions, fluidity is then a matter of temperature. Fluidity or temperature may be indirectly estimated or determined by tests methods, some of which are:

1. Spoon or cup "film-second" test.
2. Immersion of a low carbon steel rod and noting the pointing effect in a given time.
3. Fluidity or spiral mold tests.
4. Optical pyrometer reading of slag-free metal.
5. Immersion thermocouple in bath.

Measurement of temperature by the immersion thermocouple is the most accurate method, requiring no correction. The equipment required is shown in Fig. 6. It can be used only for short immersion periods of about one minute before replacement of the silica tube may become necessary. This cost item affects its use, particularly when many temperature readings are required with small furnaces. A similar condition prevails when actual casting temperatures are desired from perhaps small pots of metal. The cost of obtaining many accurate temperature readings may offset the advantages, thus favoring the use of optical pyrometers (Fig. 7).

The importance of control of actual pouring temperatures is fairly well understood. Rates of pouring also influence the quality of the product. The effects of wide variations of metal temperature are stated briefly in Table 4.

TABLE 4—POURING TEMPERATURE VARIATIONS

Temperature	Advantage	Disadvantage
1. Hot Pouring	Increased fluidity	Burned-in sand—excessive internal shrinkage
2. Proper Pouring	Ample fluidity—effective feeding of risers	
3. Cold Pouring	Minimum burned-in sand	Excessive laps and surface defects—ineffective riser feeding—entrapped gas inclusions

After cooling in the mold, the rough casting is cleaned of sand and prepared for gate and riser removal. These operations also require controlled procedures, but test methods are relatively unimportant. Likewise, controlled heat treatments are important for specific metallurgical qualities, but these are not within the scope of this paper. It is assumed that the casting has progressed through these controlled operations, is now clean and ready for inspection to determine the effectiveness of previous controls.

Inspection: Visual inspection, which discloses only conditions of surface that can be seen by the unaided eye, may suffice for many types of steel castings. Other defects may require more searching non-destructive test methods which reveal hidden discontinuities of even the minutest nature. These special operations add appreciably to the cost of the manufacturing process and, since economic considerations cannot be neglected, the desired quality level must be carefully selected with the production cost factor in mind.

Radiography: The most common and presently accepted method of non-destructive testing is radiography. Gamma ray (radium) and x-ray are employed to penetrate the steel casting, recording the passage of these rays through the casting on special films. They are then photographically developed and examined. Details of procedure need not be included here since many technical articles are available. Also, the procedure is covered by ASTM *Standards*, E-15-46, "Radiographic Testing of Metal Castings."

Fig. 7—Checking pouring temperature with an optical pyrometer. Molding and melting were under controls.

Radiographic non-destructive testing of steel castings has been employed since 1926, when gamma ray (radium) was introduced. Figure 8 shows a general arrangement of exposure to radium of a group of high strength airplane landing forks. Practical section limitation of this process is about 10 in. Figure 9 shows a 220-kv x-ray machine being used for examination of an austenitic alloy, supercharger casting. Practical section limitation with this capacity is about 1½ in.

Figure 10 shows a 1000-kv x-ray machine in position for exposure. Practical section limitation of this equipment is about 6 in. X-ray equipment of two million-volt rating is also in use. The 20 million-volt betatron is capable of penetrating 18-in. sections, and even higher powered machines have been used, but perhaps not to examine production steel castings.

The limiting factor controlling the use of non-destructive testing methods of steel castings involves correct interpretation of the results. Any method, in order to be practical, must be acceptable to the foundryman. It should not reveal false indications and should be capable of defining defects into acceptable and non-acceptable classifications.

Standards of acceptance are becoming more critical with time and inspection methods are constantly being improved, as witnessed by the progress of radiography during the past decade. Therefore, before any non-destructive method of testing for castings is established as a test means, all parties should agree upon a set of workable standards which distinguishes between flaws and blemishes and real defects. Further, suitably marked plans are needed for each design, showing critical and non-critical areas for non-destructive survey and allowable tolerances.

Some deviation from casting perfection is unavoidable, and any method of non-destructive testing can

survive only when proper emphasis is placed upon working standards, with due regard to interpretation based upon essential requirements.

Magnetic Particle Test: The magnetic particle test has gained prominence as an inspection method applicable to ferritic types of steel casings. Its use is primarily limited to surface defects, particularly cracks. The dry powder method has been widely employed by steel foundries for examination of general production castings. Figure 11 indicates the test procedure by the production method and the dusting of magnetic powder on the area subjected to the proper magnetic flux density by low voltage, high amperage direct current. Surface discontinuities are quickly indicated by a build-up of magnetic powder. A casting may be completely surveyed at a lower over-all cost than is possible with radiography.

In some instances, sensitivity of the magnetic particle test is greater than that of radiography due to the plane of the defect, which generally is at right angles to the surface.

Small cracks of only a few thousandths of an inch are revealed. These the average x-ray examination would not disclose and, of course, defects of this nature are not discernable on visual inspection. The magnetic test, on the other hand, has not proved to be of any particular value in disclosing internal defects and, therefore, does not replace radiography but rather supplements it. The magnetic particle test, like radiography, usually is applied only to the higher types of quality castings where service requirements justify the added expense.

Fluorescent-Penetrant Test: Fluorescent inspection is now being applied to both non-magnetic and magnetic types of cast materials. This method is useful only for the determination of surface defects. Internal defects are not disclosed; therefore, the end result of this method is similar to the magnetic particle test. The equipment required is not extensive, nor is any part of the operation difficult.

The casting to be inspected is immersed in, or sprayed with, a prepared highly fluorescent, light, water soluble, penetrating oil. After approximately a 10-min soaking period, the oil is allowed to drain from the casting and the excess oil on the surface is washed away with warm water. After drying the casting is ready for examination in a darkened room under a violet-ray light (black lamp), with or without a developing powder dusted over the surface. Any surface defects then appear to fluoresce with a degree of brilliance in accordance with size and direction. Results of a fluorescent penetrant test are shown in Fig. 12.

Supersonic Testing: While a comparatively new method, supersonic testing is now being used for casting inspection. The instrument sends supersonic vibrations through the casting under test, and measures the length of time it takes these vibrations to penetrate the material, reflect from the opposite side, or an internal defect, and return to the sending point. An oscilloscope pattern is produced on the screen, providing a visual indication of any defects which may be present in the material under test.

Supersonic testing is limited to relatively smooth, flat surfaces providing good contact for the searching unit crystal. Sand-cast surfaces are too rough and re-

Fig. 8—Gamma-ray exposure of high strength steel alloy airplane landing forks prior to shipment; an example of 100 per cent radiographic casting inspection.

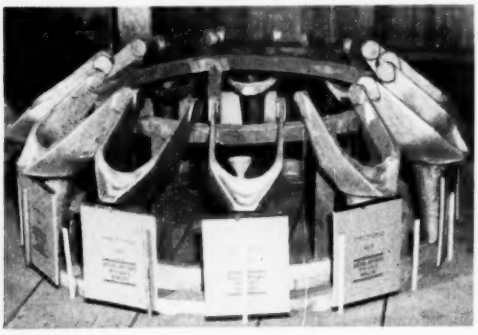
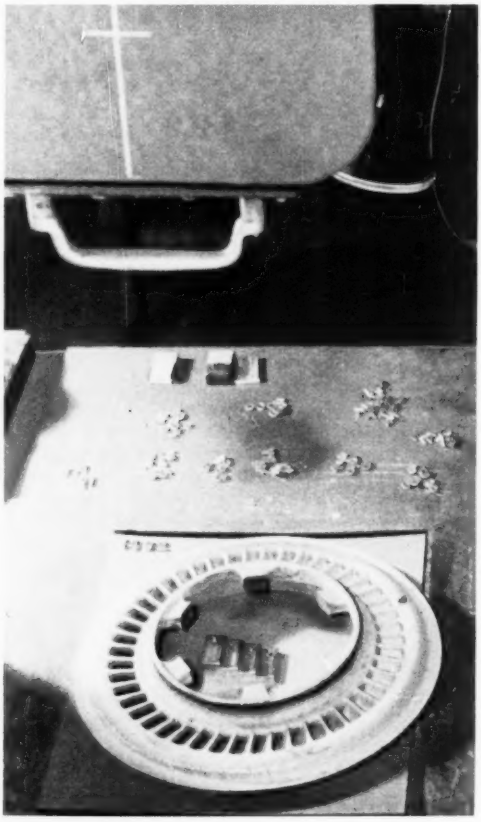


Fig. 9—220 kv x-ray machine being used for examination of austenitic alloy supercharger casting—an example of production work subject to 100 per cent radiographic inspection. Section limitation is 1½-in.



quire hand grinding. The method is not yet applicable to uneven and curved surfaces.

Metals should be dense and with a cast grain of reasonable size. Austenitic alloy castings with large crystal size and variable crystal orientation cannot be penetrated, which probably is due to sound vibrations from the crystalline grain boundaries.

There appears to be no limitation as to section thickness for the foundryman, as up to 15-ft sections of carbon and low-alloy steels have been successfully penetrated with a good degree of sensitivity. Small, irregularly shaped castings with thin-wall sections frequently are difficult to test supersonically if they do not provide suitable surfaces from which the beam can be projected into the body of the casting at right angles to the available testing surface.

The minimum wall section is of about ½-in. thickness. Testing of thinner sections is sometimes practical

Fig. 10—1000 kv x-ray machine being adjusted prior to exposure. Practical section limitation is about 6-in.

when the sound vibrations can be passed through the flat edge, which actually represents a much heavier section (width).

Sensitivity of the present equipment appears to be adequate for the exploration of castings. It is reported that defects in regular steel can be detected if the defect size is 0.1 per cent of the distance from the testing surface. At a distance of 5 in., a defect of 0.005-in. thickness should be easily detected.

Records of defects are not possible, as all images are visually read from the oscilloscope pattern, as shown in Fig. 13. The casting tested by the oscilloscope pattern (Fig. 13) has been sectioned and the defects shown in Fig. 14. The testing equipment is shown in Fig. 15. Defects can be disclosed only when the beam reflections pass over the area at right angles. The location on one

Fig. 11—Magnetic particle testing of a high pressure, low alloy valve body during the cleaning process. Surface defects which would not be found by normal visual inspection are easily detected by use of this method.

plane is established, and by calculation the distance from the surface is estimated. In order to explore all areas, complete scanning of all sections is required. This appears to be a tedious method and, if full coverage is required, radiographic examination may be more economical.

Other Non-destructive Tests: Static loading non-destructive tests of castings are commonly being applied to finished structural components to prove their suitability for the service intended. Many of the parts are subjected to predetermined live-load tests simulating service conditions, followed by measurement of the amount of deflection and permanent set.

This type of non-destructive test determines not only the quality of material but is often used in the development of satisfactory designs. For proof tests, these parts are subjected to stresses well below the elastic limit, with the usual specifications not allowing any permanent deformation. Loading is usually one and one-half times or more than the maximum service loads, and this test segregates castings or designs with substandard strengths.

Static proof testing is often applied to castings with known defects, as disclosed by other methods of non-destructive testing. These castings are proof loaded, checked, and reloaded with increased loads until permanent set or destruction has occurred.

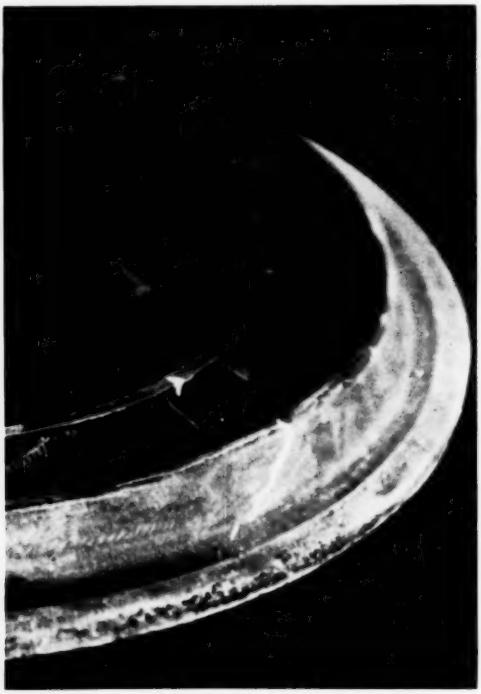
This information, coupled with actual service results, aids in establishing the permissible extent of casting defects allowable with some margin of safety. Location of defect with size, type and direction as disclosed by other non-destructive tests should be taken into account, thus forming workable standards of acceptance or rejection for the particular parts involved.

Hydrostatic testing of pressure-type castings has superseded practically all forms of non-destructive testing. It is being regularly applied as a final inspection method to fittings at standard pressures in excess of their normal working pressure, even though radiographic and other non-destructive tests have been applied. Air pressure tests, at pressures often greater than the working pressure, are common with the castings immersed in water.

An air test of unmachined pressure fittings is frequently applied in foundries, using a water-soap solution and observing any bubble formation indicating unsoundness. Likewise, steam, cold and hot oil pressure tests are used. Any of these tests are for the purpose of segregating "leakers" or defects which pass from wall to wall of the casting.

Still other non-destructive tests are employed for examination of steel castings, in this country and abroad. Their use is somewhat limited to special applications, and it is not possible to cover details of these specialized procedures.

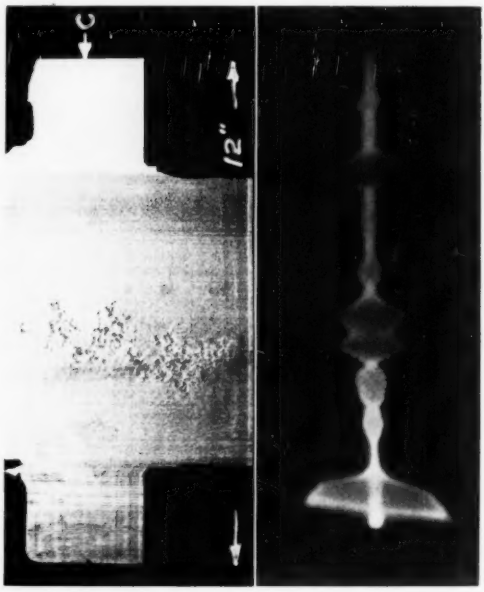
Dimensional Tests: Jig gaging on production castings as a final inspection is used as a means to insure stock for machining, including proper fit of the casting into machine tool fixtures (Fig. 16). Individual layout procedure, with thorough checking of dimensional tolerances and wall thicknesses, is always a recommended practice on pilot sample castings. It is difficult to indicate limits of dimensional tolerance of production castings in a blanket manner, but ± 5 per cent or ± 1/16 in. in wall sections has been accepted for certain classes of steel castings for some applications.



Destructive Tests: In proving metallurgical qualities and effectiveness of previously discussed controls, destructive tests are regularly employed. Physical testing of the casting, test coupons from or attached to it, or separately cast and processed with the casting, are necessarily destructive to indicate the qualities of the respective lot. Some of these tests are so well known that test procedures need only be indicated as follows:

1. Chemical or spectrographic analysis.
2. Tensile test (Standard 0.505-in. dia., 2-in. gage length).
   (a) Tensile strength.
   (b) Yield point or defined yield strength.
   (c) Elongation, per cent.
   (d) Reduction of area, per cent.
3. Bend Test (½ x 1-in. specimen).
4. Hardness.
   (a) Brinell hardness.
   (b) Rockwell "C" (for harder grades).
5. Impact tests.
   (a) Charpy keyhole notch.
   (b) Charpy "V" notch.
   (c) Izod.
6. Jominy hardenability test.
7. Microstructure or grain size.
8. Hot acid etch for macro-examination.
9. Corrosion tests.

Specifications usually require but a few of the tests listed in the foregoing, depending upon the service ap-



Figs. 13 and 14—A 12-in. casting, sectioned, showing internal shrinkage. The quartz reflectoscope crystal was placed at "C" with the resulting oscilloscope pattern shown at the right. The two large pattern reflections represent the sending point "C" and the opposite wall. Variations of pattern represent discontinuities.

Fig. 12—An austenitic alloy supercharger casting being inspected by the fluorescent-penetrant method. Surface defects, which are cracks in this instance, would not be disclosed if visual examination alone were employed.

plication. Other qualifying tests of specialized nature are often needed. Items 1 and 2 are common requirements and are specified within certain limits as to composition and physical characteristics. Item 3 refers to ductility as determined by a simple bend test. When ductilities are quantitatively determined by the tensile test, this additional test by bending is obviously a duplication of effort.

Hardness tests (Item 4) are relatively easy to make on test pieces or production castings. Brinell hardness testing leaves a permanent mark of test that could be considered non-destructive. It is to be preferred for foundry operation over the Rockwell method since

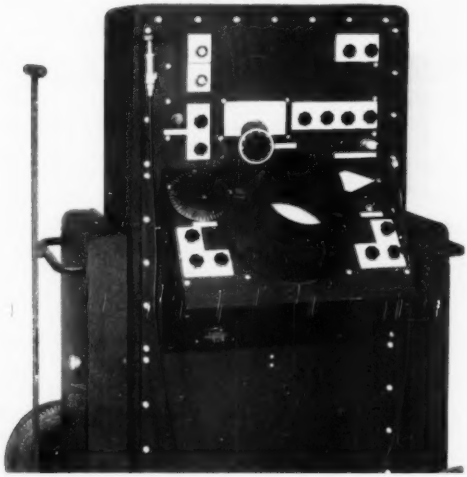


Fig. 15—Supersonic testing equipment capable of penetrating massive sections up to about 15 feet.

the Rockwell test machine is too fragile for rough usage with heavy pieces. The Brinell hardness test in the foundry is often employed for 100 per cent inspection of certain high strength, high quality production castings. The result of the hardness test is directly related to the tensile strength.

Impact properties (Item 5) are not related to other physical property tests. This statement does not apply to cast steels alone. The specimen is machined to 10 millimeters square, notched at the fracturing point, and to a standard length (Ref. A.S.T.M. Impact Testing E-23-41T). The fracture is accomplished in a calibrated impact testing machine recording the energy absorbed by the specimen. The keyhole type specimen appears to have preference over the V-notch or Izod specimen due to the better ability of reproduction of the notch and duplication of results. When cast steels are to be used at sub-zero temperatures, the Charpy keyhole impact test is often a specification requirement, with the test being conducted at minimum service temperatures.

Certain grades of steel castings are produced for service requirements, dictating that certain physical

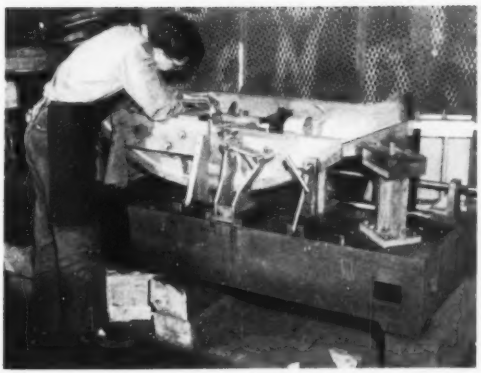


Fig. 16—A heat treated, high tensile alloy casting being jig-gaged in target fixture before shipment. This inspection insures proper and adequate finish allowances with over-all dimensional tolerances suitable for the subsequent machining operations by the customer.

properties and structures will be inherent upon heat treatments of quenching and tempering. The Jominy hardenability test discloses the hardening characteristics, such as depth of hardening, which is function of cumulative alloy content. This test (Fig. 17) requires a test piece of 1-in. diameter and about 4-in. length, which is heated to hardening temperature and then quenched on one end only in a fixture under controlled conditions.

Rockwell "C" hardness readings are taken after grinding flats along the specimen sides. The hardness readings are noted with respect to the distance from the quenched end, and the results plotted. The test is primarily adapted to quenched and tempered alloy grades of cast steel where physical properties and microstructures are important adjuncts to highly stressed parts. It is also a valuable guide toward the selection of alloy and alloy content compatible with casting section size in order to avoid excesses or deficiencies in this respect.

Microstructure and grain size of cast steels are disclosed by metallographic testing. This test reveals many telltale facts and conditions of metallurgical processing, including melting, deoxidation, heat treatments, inclusions and machining qualities. A polished sample is examined under a microscope, either before etching for inclusions or voids, and after etching to develop phases and their distribution. These tests for microstructure and grain size are occasionally specified, but more frequently are used for control measures and an aid in process development.

Microstructures of test pieces or actual cross sections of castings are employed for the purpose of disclosing primary austenitic grain size, conditions of progressive solidification, segregation, or density. This test is often referred to as the deep-acid-etch test, which is made as the term implies. It is not a common specification requirement for steel castings, is definitely destructive, and if overdone or improperly interpreted will generally result in considerable controversy.

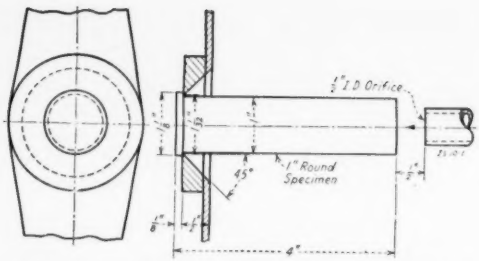


Fig. 17—Sketch showing hardenability test specimen in fixture for Water Quenching. (SAE Handbook, 1947; Method of Determining Hardenability, p. 304.)

Some of the test procedures for quality control of steel castings have been covered, in an endeavor to indicate accompanying advantages that may be realized when properly coordinated efforts are applied in all departments toward maintaining quality standards for steel castings. These process controls, starting with uniform grades of properly selected raw materials, exacting process controls of manufacture, and finally inspection of the product under established and mutually agreeable specification requirements will result in greater customer satisfaction and increased confidence in the use of steel castings by the engineering profession.

With exacting control procedure, the quality level of the product is bound to be elevated. Lower production costs must be reflected according to the coordination of process control specification requirements with effective and flexible enforcement methods employed. This leads the way toward even higher quality steel castings to meet specification requirements and service applications yet to be devised. The steel foundry must recognize its future course, adopting methods of control for more uniform qualities of production steel castings.

Future Meetings and Exhibits

INDUSTRIAL FURNACE MANUFACTURERS ASSOCIATION, meeting, Cleveland—Jan. 24-25.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, annual meeting, Chicago—Jan. 24-28.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, winter general meeting, Hotel Pennsylvania, New York—Jan. 31-Feb. 4.

STEEL FOUNDERS' SOCIETY OF AMERICA, annual meeting, Chicago—Feb. 9-10.

WISCONSIN REGIONAL FOUNDRY CONFERENCE, A. F. S. Wisconsin Chapter, Milwaukee—Feb. 10-11.

ASSOCIATION OF AMERICAN STATE GEOLOGISTS, San Francisco—Feb. 11-12.

IRON AND STEEL AND INSTITUTE OF METALS DIVISIONS, American Institute of Mining and Metallurgical Engineers, annual meeting, San Francisco—Feb. 13-17.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS, annual meeting, San Francisco—Feb. 14-17.

BIRMINGHAM REGIONAL FOUNDRY CONFERENCE, A.F.S. Birmingham District Chapter, Birmingham, Ala.—Feb. 17-19.

MALLEABLE FOUNDERS' SOCIETY, western sectional meeting, Palmer House, Chicago—Feb. 25.

AMERICAN SOCIETY FOR TESTING MATERIALS, spring meeting and committee work, Edgewater Beach Hotel, Chicago—Feb. 28-Mar. 4.

MALLEABLE FOUNDERS' SOCIETY, eastern sectional meeting, New York—Mar. 4.

AMERICAN SOCIETY OF TOOL ENGINEERS, 17th annual meeting, Hotel William Penn, Pittsburgh,—March 10-12.

OHIO REGIONAL FOUNDRY CONFERENCE, A.F.S. Ohio Chapters, Ohio State University, Columbus—Mar. 11-12.

CHICAGO TECHNICAL SOCIETIES COUNCIL, conference and production show, Stevens Hotel, Chicago—March 14-17.

MALLEABLE FOUNDERS' SOCIETY, western sectional meeting, Palmer House, Chicago—Mar. 25.

ANNUAL SAFETY CONVENTION AND EXPOSITION, Hotel Pennsylvania, New York—Mar. 29-April 1.

AMERICAN SOCIETY FOR METALS, Sixth Western Metal Congress and Western Metal Exposition, Shrine Auditorium, Los Angeles—April 11-15.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS, National Open Hearth Steel Committee, annual meeting, Palmer House, Chicago—April 18-20.

American Foundrymen's Society, 53rd Annual Foundry Congress, St. Louis—May 2-5.

Chapter Takes Meetings "On Tour" For Benefit Of Outlying Membership

A SERIES OF THREE AREA MEETINGS, designed to bring technical sessions of the Northwestern Pennsylvania chapter to its members who, because they live in outlying towns find it inconvenient to attend the chapter's regular monthly meetings in Erie, began November 12, when the chapter convened at the Shorewood Country Club, N. Y. More than 150 foundrymen attended.

Held under the chairmanship of J. Marcus Morrison, U. S. Radiator Corp., Dunkirk, the meeting began with a dinner, followed by a musical program played by the all-violin orchestra of the Fredonia State Teachers' College.

Dr. Willard F. Stanley, the College's professor of Biology, gave an interesting and unusual coffee talk on "Facts and Fiction About Snakes".

Technical speaker of the evening was C. R. Simmons, Durez Plastics and Chemical Corp., North Tonawanda, N. Y., who accompanied a talk on plastic patterns with an actual demonstration of plastic patternmaking and showed a series of slides illustrating the advantages of of this method of patternmaking.

Started Mailing 1948 Transactions

MAILING OF PREPUBLICATION ORDERS for the 1948 issue of TRANSACTIONS OF A.F.S., volume 56, started shortly after the holiday season. Difficulty in obtaining cartons delayed mailing until the heavy traffic of late December when it was considered inadvisable to send out the volume.

The paper bound volumes which were made available prior to publication for $1.00 to A. F. S. members no longer can be obtained. Cloth bound copies can be ordered by members for $7.00, by non-members for $15.00.

Company and sustaining members of the Society who made prepublication request on forms provided are receiving gratis cloth bound volumes of this latest issue of the annual TRANSACTIONS.

FOUNDRY CAREER OPPORTUNITIES

J. B. Caine
Metallurgist
Sawbrook Steel Castings Co.
Lockland, Ohio

Giving impartial attention to advantages and disadvantages of foundry work for engineering school graduates, "Foundry Career Opportunities" was excerpted from a talk made by J. B. Caine at the installation of the A.F.S. Ohio State University Student Chapter. Closely related to this paper is "Engineer in the Foundry" by Marvin W. Williams, in the March, 1948, issue of *American Foundryman*.

"WHERE AM I GOING TO WORK?" is a question of paramount importance to every young man. His decision, although influenced by many factors, will be based primarily upon his own aptitudes and qualifications, and secondly upon the relative opportunities offered by various lines of work. In recognition of this, the foundry industry is today making a sincere effort to interest young men, especially those with technical backgrounds, in the foundry not only as a place to work, but as a profitable career.

In furthering this effort, it is important that the advantages and disadvantages of the foundry from the standpoint of a technical man be discussed frankly. It is because this is to be an impartial discussion that I wish to make it clear that I am more sold on the possibilities of the foundry industry and its products than when I entered it 25 years ago. Undoubtedly, many of the disadvantages that will be discussed apply to a greater or lesser degree to many other industries. It is well to bear this in mind while looking at both advantages and disadvantages of foundry work.

A common criticism of the foundry industry—backwardness—does not apply to many foundries. It is the unprogressive attitude of a substantial minority that reflects upon the industry as a whole.

The so-called backwardness is at the same time a drawback and an incentive. Many foundries have the most modern, efficient equipment money can buy and the finest production systems possible, yet their laboratory, if they have one at all, is likely to be a shack somewhere in the corner and their metallurgist is simply an analyst, or an ornament.

One of the obvious advantages the foundry industry offers a technical man is the opportunity to grow with an industry. The great disadvantage is the indifference on the part of the majority of foundries to the importance of technical knowledge and control.

By far the most universal "gripe" of foundry metallurgists and technical men is not working conditions or pay—it is management's indifference to their efforts. The great majority feel that they are considered a necessary evil at best—and many wonder if they are even considered necessary at all. Again this state of affairs is not restricted to the foundry industry, but is prevalent to some degree in all industry.

The wrought metals industry, especially within the last 10 years, has come to depend upon and to appreciate the technical man much more than does the foundry industry, not because it particularly wants to, but because it has too. The modern strip mill, for instance, simply runs too fast to be controlled by the old rule-of-thumb methods. Unlike the foundry industry, the chemical industry has been built on and around the laboratory and the technician.

Indifference of foundry management is a challenge to the technical man to sell himself and his knowledge. If the foundry industry would apply half the published knowledge that is now available, it would advance five years overnight. It is up to the technical man to sell his knowledge to production men—no one will do it for him.

There should be twice as many cast parts in use today as there are. Many parts now being formed by other methods could be produced more economically as castings. This is not a wild statement, but is based on incontrovertible fact. Fundamentally, casting is the most efficient method of forming a part because there are only two operations—melting and casting. To form a wrought part, these same two operations must be performed, followed by additional heatings, coolings and workings, oftentimes resulting in a dozen or more operations before the wrought part is formed.

In spite of the theoretical efficiency of casting, a cast part may cost from 2 to 20 times as much per pound as a wrought part of the same metal. Why? The answer is inefficiency—not human inefficiency, but technical inefficiency.

True, there is one inefficient casting operation that at present seems indispensable, that of making an

What to Study in a Company When Looking for a Job

1. Stock ownership.
2. Balance sheets for a period of years.
3. Earnings statements for the last ten years.
4. Products.
5. Markets and market positions.
6. Sales stability.
7. Policies on insurance, pensions, and other security provisions.
8. Pay policies—comparatively.
9. Engineering and research.
10. Do good people stay on and seem to enjoy their work?
11. Are promotions normally from within the ranks? Does the company gamble on its own people?

From an address by William B. Given, Jr., president, American Brake Shoe Co., New York, who spoke on *"Rating Better People"* at the Gray Iron Founders' Society annual meeting, October 14-15, 1948, Atlantic City, N. J.

individual mold for each casting. This inefficient operation can be eliminated even for steel, by permanent mold casting and die-casting. These methods not only eliminate the individual mold, they eliminate practically all machining, because parts can be die-cast to dimensions measured in thousandths of an inch. These types of casting are being performed today and are part of the foundry industry.

At present, these processes are limited to the lower melting point, relatively weak and expensive metals, but there is no reason why they cannot be applied to the cheaper, stronger metals such as iron and steel.* Metallic mold materials are available—only necessary is the elimination of many complex, costly difficulties in the processes for higher melting point metals. This is a job for the technical man, but first he must sell management on the possibilities of these processes for the cheaper metals, and sell them convincingly enough that management will gamble the many thousands of dollars necessary for this work.

Casting Process Has Advantages

Even dismissing permanent molding and die-casting of iron and steel, there are still millions of tons of additional business that can be produced with present equipment. Many parts now being machined out of wrought stock can be produced more cheaply by casting, even though the cost per pound of the casting may be many times that of the rough wrought stock.

A casting requires less machining. Machining is such an inefficient forming method that a slight decrease in the amount of metal to be machined off will more than offset a much higher cost of the rough part. Again, this is a job for the technical man, not only to prove to the customer that a casting will perform as satisfactorily as the wrought part he is now using, but also to show his foundry how to produce a cast part that will do the job.

There is another detail that adds to the cost of the casting, such a costly and necessary detail at present that the foundry considers it a part of the overall operation—that of finishing the casting after it is cast. This is another job for the technical man—to find out how to make the casting in the foundry and not in the cleaning room, and to sell his ideas to the production men.

As an example of the potentialities of castings, there were about 85 million tons of wrought steel produced in this country in 1947—a lot of steel! The capacity of the steel foundry industry is about 3 million tons a year. It would not require much nibbling on the edges of the wrought steel business to double the steel castings output.

Somewhat the same relationship in production holds true for other metals that can be cast and wrought. Cast iron is, of course, the exception for there is no wrought cast iron. However, cast iron is competing with steel—steel processed as weldments as well as forgings and screw machine stock. A little nibbling around the edges of wrought steel tonnage will do wonders for iron foundries and the men working in them.

So much for the opportunities and limitations of the foundry industry and its major working advantages and disadvantages. Now for the minor ones.

Some think the foundry is a dirty place. Any dirt there may be is clean biologically and washes off easily —something that cannot be said for the oily, skin-permeating dirt found in places that look much cleaner than the foundry.

Some foundry work is hot and there is some physical effort required. Heat cannot be eliminated entirely because it is required to melt metal and it is necessary for some foundry employees to work near hot metal and hot castings. However, the more progressive foundries are eliminating the combination of heat and physical effort. It is remarkable how little heat affects the worker who has only to push a button.

It is a popular though erroneous conception that the foundry is a dangerous place to work because of the molten metal. Actually, accident frequency rates, at least for steel foundries, are in line with those of comparable industries. Surprisingly enough, the accident frequency rate in the cleaning room, where the metal is cold, is many times that of those departments where metal is handled in a molten state.

The answer is simple—molten metal commands instinctive respect and is handled accordingly. The only occupational hazards are silica dust and some metal fumes in some non-ferrous foundries, both of which are easily controlled by proper ventilation.

"Never a Dull Moment"

There are a number of minor advantages to foundry work that deserve attention. The great majority of foundries is small, and the employee doesn't become "stuck in a rut," as is true of many workers in larger industries. Foundry work is not boring. There is always something new and different turning up—always a new problem, a new challenge.

If the prospective foundryman has that intangible attribute, the ability to make people like him, the place for him is sales. A technical education will not be wasted in this work for recognition of the importance of technical salesmen is increasing. This is a new field in the foundry industry, but an important one, for here success comes to the man who has the ability and opportunity to recognize parts in the customer's plant that should be cast, who can talk to the designer in his own language, and who can help design a part that can be cast efficiently, and who, above all, has the ability to sell the designer on castings.

If the potential foundry employee cannot sell, but has the ability to handle men, he belongs in foundry production work. Here, again, the foundry industry needs supervisors who use a technical background as a basis for their decisions.

What have you to offer the foundry industry? Your interest and time—not for eight hours a day and 40 hours a week—but for every spare minute. Your education is just beginning when you leave school, and must be kept up. After graduation your school will be the foundry itself and the technical organizations and metallurgical organizations such as the American Foundrymen's Society. There are no formal examinations—but grades come out in the pay envelope.

* Editor's Note: Two United States foundries and one British foundry have recently been reported to be producing steel castings by centrifugal permanent mold processes.

USES STANDARD PERMANENT MOLD EQUIPMENT

THE PERMANENT MOLD PROCESS was originally carried on with manually-operated lever-type, single head machines. Subsequent improvements resulted in a cam-operated turntable and, finally, the 12-head, semi-automatic, air-operated machine with rotating molds and suction cooling of today. This machine consists of a large base on which revolves a dodecagonal hub. Twelve hollow arms, extending radially, are bolted to the hub. Joining the arms at the extreme ends are the outer heads, with a half mold attached. These outer heads are cast with a hollow section permitting approximately 500 cu ft of air per minute to be drawn across the back of the mold, through the head into the radial arms and through the hub. The 12 inner, or moving, heads are mounted on rollers, movement being obtained through 8-in. air cylinders controlled by three way valves which alternately, close, open, and hold the molds.

Each inner head has a telescopic device which allows a continuous flow of air across the back of the

This exhibit of permanent mold gray iron castings made by the foundry division of the Eaton Manufacturing Co., Vassar, Mich., was displayed in the lobby of the Vassar Savings Bank as an example of local industry. Later, the exhibit was shown to the Vassar Rotary Club and to the Vassar Junior Women's Club at the plant.

inner half mold, equal to the volume flowing across the back of the outer half mold. The molds are attached to the heads by means of two bolts for each half mold. Both inner and outer halves can be changed in 15 minutes by one man.

An acetylene flame, which deposits a coating of carbon on the molds as they pass by, is controlled by a cam attached to each outer head. These cams also start and stop the blowing arrangement that cleans the molds of excess soot and dirt.

Rotation of the machine is provided by a ring gear attached to the 12-sided hub, and a pinion driven by an electric motor through a speed reducer. The reducer makes possible speeds from one revolution in two minutes to one revolution in six minutes.

Each casting machine requires two attendants—one to pour and one to eject the castings. All operations are performed while the machine is in motion. An additional operator is required for cored castings.

Molds Are Interchangeable

All molds used with the 12-head machine are standard and interchangeable; four sizes cover the entire range of castings produced. The molds are all hollow-backed with a box-like side wall. Cooling pins approximately ⅜ in. in diameter cover the back of each mold to assist in maintaining the mold temperature at the proper level. Bosses to attach the mold to the head and side bosses for the dowel pins are cast integrally. Runners are located at the bottom of the down sprue, in a horizontal position, and run across practically the entire face of the mold. The mold cavities are above the runner and are connected by gates.

In multiple molds, one cavity is placed above the other and the riser of the bottom cavity serves as the gate for the upper cavity. The top of the mold, which is at a five degree angle to the face, is divided into three parts—the center acting as a pouring basin and the two outer sections serving as pools for over flow metals from the risers.

The procedure followed in making a new mold is: casting in dry sand; sandblasting; ⅛ in. machine cut on top and bottom face; inserting dowel pins; laying out the cavity; machining the cavity; installing vent plugs; and coating with refractory material. The refractory coating is applied to the mold at about 400 F and is followed by a carbon smoke (the doubled coating is covered by basic patents). The first check for dimensional accuracy is made with molten lead. Subsequent tests are made with iron to check gates, risers, and vents and adjustments are made at this point. Controlled directional solidification is obtained by proper mold design.

Before placing the machine in operation, the molds are preheated to about 500 F. The operating cycle varies from two to six minutes, depending upon the size of the casting. After solidification, the castings are completely annealed to remove stresses caused by quick setting of the metal and to eliminate small corners of white iron. In annealing, the castings are brought to 1575 F in an hour-and-a-half. The scale incidental to open furnace operation is removed by shot blast and the castings are ready to machine.

Design Gives Flexibility

The design of the machine and the standardization of mold sizes give considerable flexibility; 12 identical molds or 12 different molds can be used at the same time on one machine. The only qualification is that the mass of metal in each mold be in balance with that in the other molds, to provide a uniform pouring and cooling cycle.

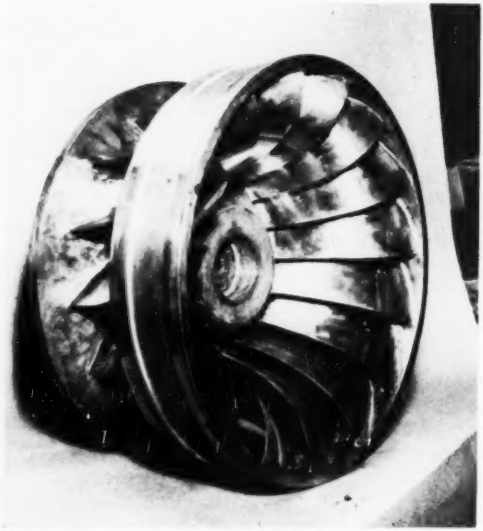
Castings produced by the permanent mold process are reported to be particularly uniform throughout the entire range of section and to be free of porosity. The absence of porosity and segregation is credited to the rapid cooling characteristic of the process.

Users of permanent mold castings have reported that faster speeds and feeds may be employed in machining the castings thereby lowering machining costs.

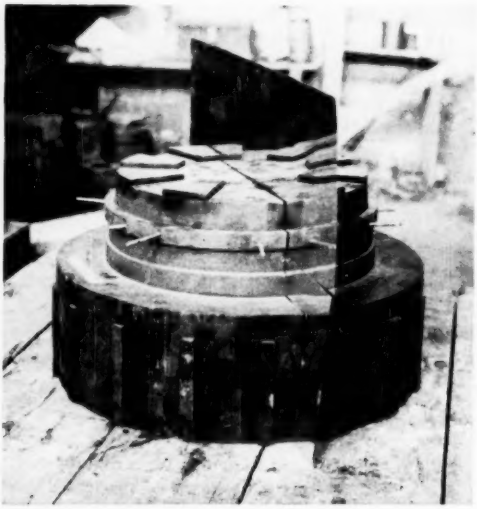
EDITOR'S NOTE: This story of the talk by E. C. Hoenicke, Eaton Mfg. Co., Detroit, at a chapter meeting of the Northern Illinois-Southern Wisconsin Chapter, was reported by Carl L. Dahlquist, Greenlee Bros. & Co., Rockford, Ill.

MODERN FOUNDRY METHODS...

Molding a One Piece Bronze Turbine Runner Model Casting

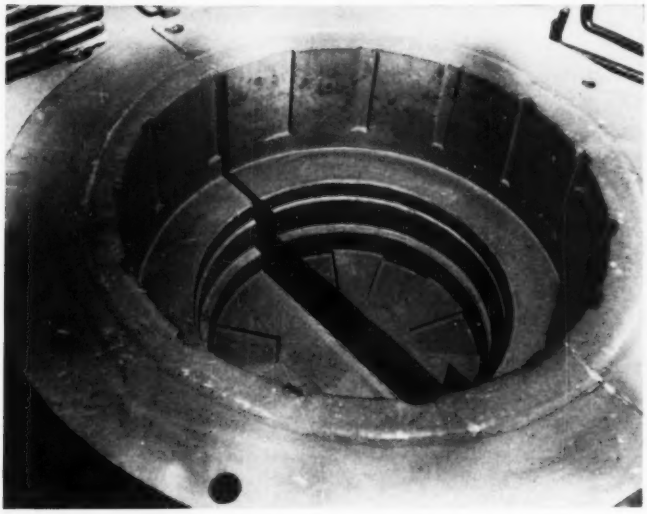


In a paper presented at the All-Canadian Foundry Conference in Montreal, Que., Sept. 30 and Oct. 1, 1948, H. W. Bennett, Dominion Engineering Works Ltd., described an unusual technique used to cast 150 lb bronze pilot models of hydroturbine runners. Shown at left and above are the rough casting, just removed from the sand, and the finished casting. Pilot runner castings are made to enable the designing engineer to determine the most efficient design for large steel turbine runners to meet requirements in large water-power developments, and for that reason must be dimensionally accurate. The vanes are about ⅜ in. at the heaviest section, and taper down to less than ⅛ in. The casting must be made without misruns or cold shuts. Welding of defects is not permitted because of resulting distortion of the vanes.

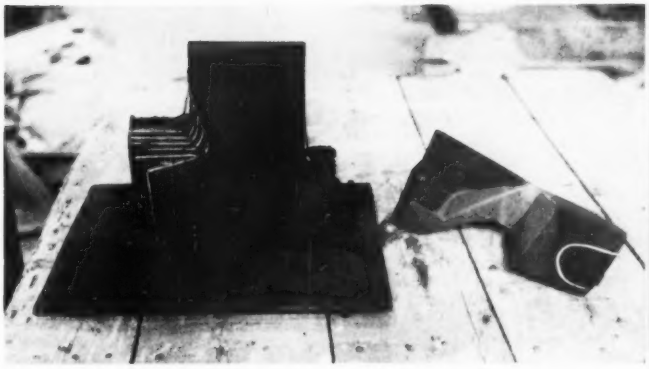


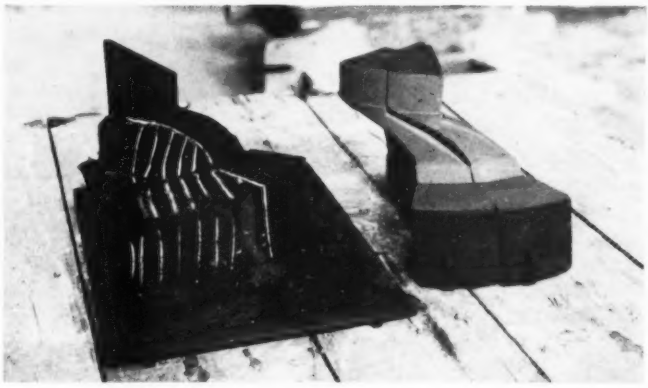
Left—Pattern used to mold the runner casting is a split pattern, dowelled and pinned like any other split pattern. A section of sheet metal is placed between the pattern halves. The pattern is then fastened together, slots having been cut in the sheet metal so that it will not be locked in the pattern by the dowel pins but will remain in the mold when the pattern is withdrawn.

...MODERN FOUNDRY METHODS



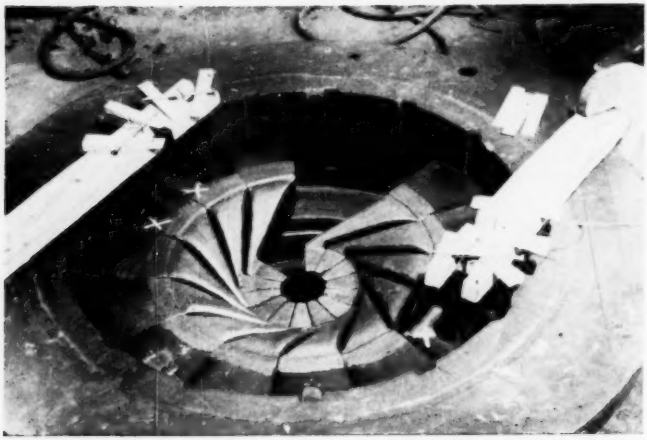
Left—Drag half of the mold showing the sheet metal in place, dividing the mold cavity and extending between the joints of the two sections of the flask. The mold rests on a machined iron plate; the top and bottom flanges of the flask are also machined. This enables the molder to slide the two halves of the drag apart easily for removal of the sheet and placing of the vane cores. After removing the sheet and cleaning out any loose sand between the sections, the mold is drawn together and checked for perfect roundness and even bottom surface. Two guide lines are drawn across the dividing line of the mold on each side of the upper flange so that the molder will be able to check the sections for proper position after drawing apart and reclosing.





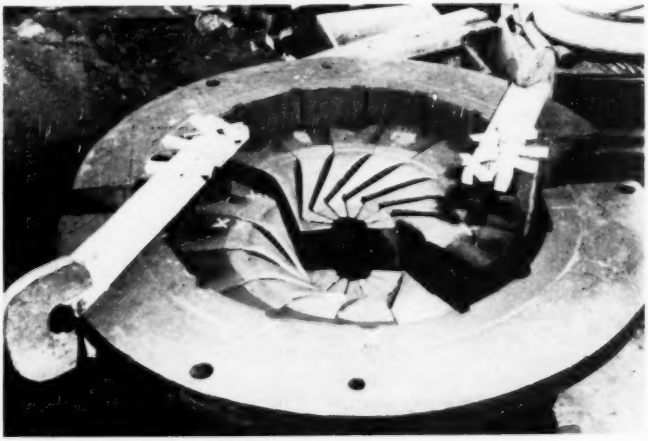
Right—The vane cores are made of open sand sufficiently fine to prevent penetration of the hot metal used to pour the castings. An additional penetration preventive is the heavy coating of blacking. Strength and high collapsibility are essential, and the cores must be dimensionally accurate to better than 1/64 in. As the core is placed and replaced several times before it is finally set to the required dimension, it must be hard enough to withstand considerable handling. The white lines on the photographs indicate the area where bedding material was used. The methods used for final mold assembly and in maintaining the required dimensions for vane thickness are illustrated and described on the following page. All photographs used to illustrate the techniques of these molding operations were furnished by H. J. Lawson, Dominion Engineering Works.

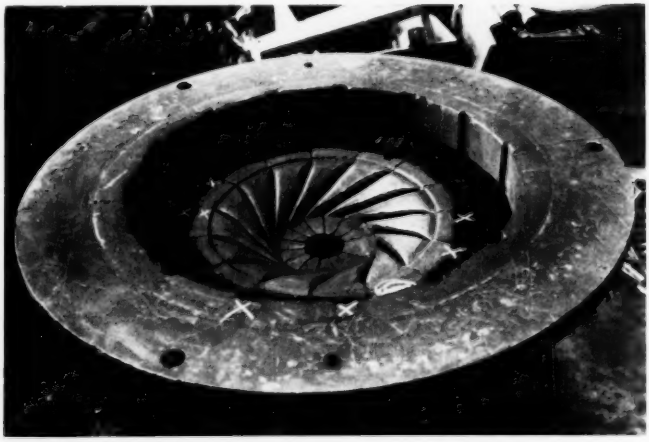
MODERN FOUNDRY METHODS...



Left—Mold assembly has reached the stage where it is necessary to draw the mold sections apart in order to set the two remaining cores in the open space shown in the photographs. Note the preparations made to suspend the cores marked "X" while the mold sections are separated. The cores which will be suspended during mold separation lie across the dividing line of the mold. These cores are top-heavy, the greater part of the weight resting on the ledge or upper coreprint.

Right—After drawing the mold sections apart the key core is carefully marked for location and removed from the mold. The two remaining cores are then set in position and the key core replaced according to its location marks. The key core is the first core to be placed in the mold, and from its location all other cores are set to the required dimensions.





Left—All cores have been set and the mold sections drawn together. Before placing the cope core the mold is again checked. Some small adjustments may be necessary, and these are made by pressing small pieces of sheet metal between the coreprints to bring the vane thicknesses to the required dimensions. After the adjustments have been made the cope core is placed in position and the mold made ready for pouring.

BELGIAN RESEARCH ADVANCES NODULAR GRAPHITE THEORY

Albert De Sy
Professor of Metallurgy
University of Ghent
Belgium

The 1948 Exchange Paper of the Belgian Foundrymen's Association to the French Foundrymen's Association is made available to A.F.S. members through the courtesy of these organizations. The author advances the hypothesis that the crystal system of the nuclei or solid particles suspended in molten gray iron determines whether nodular graphite or flake graphite will be precipitated.

GRAY CAST IRON IS AN AGGREGATE of steel and graphite; steel constitutes the matrix which is interrupted by numerous flakes of graphite. The proportion of graphite is low in weight but high in volume, and therefore important as regards the discontinuity of the metallic matrix.

Graphite has but a very low tensile strength and scarcely adheres to the steel matrix. This explains why the rupture of gray iron is always intergranular; it follows the surfaces of lesser cohesion, the graphite-metallic matrix surfaces of contact. The alternation of black lamellae and metallic areas causes the gray appearance of the rupture of gray cast irons.

Some 50 years ago, the strength properties of cast iron received very little attention. The main asset of cast iron to be exploited was its fluidity or running qualities, and the tensile strength averaged only 21,000 psi. The knowledge at the time hardly permitted better. Much progress has been made in the past half century, and irons averaging 35,500 psi are now regularly produced. Less frequently, tensile strengths reach 42,000 to 57,000 psi. Exceptionally, and by processes which are not yet common practice, cast irons of more than 57,000 psi tensile strengths are produced.

If the possibilities of improving the strength properties of ordinary gray cast iron are examined, two are evident: (1) increase the strength of the steel matrix; (2) decrease the total carbon and thereby reduce the percentage of graphite. The first factor has lead to the production of pearlitic cast irons, and the second to low-carbon pearlitic cast irons.

Low-carbon pearlitic cast iron (less than 3 per cent carbon) is intermediate between ordinary gray iron and steel; in progressing in this direction, the foundryman obtains a substantial improvement of some of the mechanical properties of cast iron, but on the other hand, loses to a considerable extent the advantages of good fluidity and low shrinkage.

Apart from these two ways of improving the mechanical properties of gray cast iron, there is also a third—influencing the size, shape and distribution of the graphite. This means has received the attention of research workers for the past 15 or 25 years. We would immediately point out that the third means, which does not necessarily impair running properties, is favored by foundrymen.

A normal structure cast iron is one which has lamellae of graphite in a pearlitic matrix. This structure does not correspond to the best characteristics for the given composition since nodular graphite, such as is produced commonly by annealing, is far more advantageous and corresponds to superior mechanical properties. Shock resistance and ductility are specially improved by this form of graphite.

In conformity with the Fe-Fe_3C and Fe-graphite diagram (Fig. 1), the solidification of an iron-carbon alloy containing 1.7 to 4.3 per cent of carbon starts by the crystallization of non-saturated austenite dendrites, and is completed by the eutectic deposit in the interdentritic spaces.

In a similar manner, the solidication of hypereutectic alloys starts by the formation of cementite or graphite crystals, and ends by the deposit of the eutectic.

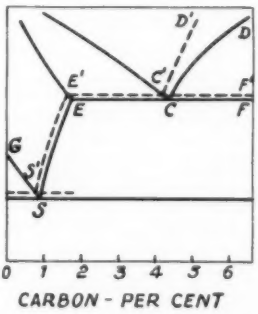


Fig. 1—Fe-Fe_3C and Fe-graphite diagram.

If, as is the case for ordinary gray cast iron, the carbon largely crystallizes in the stable form of graphite, the structure of iron-carbon alloys, such as is shown in current metallographic practice, is not at all what would be expected from examining the constitution diagram (Fig. 1).

Indeed, normal structure cast iron presents lamellae of graphite scattered in a mass of pearlite (Fig. 2).

In examining this structure no one can say whether the alloy is hypoeutectic, eutectic or hypereutectic. The structure results from the manner in which the eutectic solidifies in relation with the pre-existing crystals.

In a normal gray cast iron of eutectic composition the crystallization of the eutectic starts at different places at the same time from nuclei distributed in the mass, and propagates radially, i.e., the front of crystallization is practically spherical.

During the process of crystallization, the eutectic exists in the form of rosettes or spherical grains, and the solidification ends by the meeting of these grains. The structural relations between the graphite and austenite, the two phases of the eutectic, vary with the composition of the alloy and many other factors. Normally the graphite crystallizes in flake form, and the austenite appears as a filling element.

In view of the small number of graphite flakes in each eutectic rosette, the plane sections of the solidified alloy hardly show the radial system of growth of the eutectic grain.

Through appropriate treatments it is possible to obtain much finer graphite, and consequently a much

Fig. 2—Photomicrograph showing the structure of pearlitic cast iron.

larger number of flakes; then their radial disposition around the crystallizing centers of the eutectic grains appears.

Let us momentarily consider the structure defined as normal for hypoeutectic cast irons. In this case, solidification starts by the crystallization of non-saturated austenite dendrites. After this first phase, the eutectic crystallizes in the manner previously described and without any relation to the pre-existing dendrites. During the second phase of solidification the primary dendrites and the growing eutectic rosettes are immersed in the liquid. Solidification ends by the meeting of the rosettes, the latter uniting among themselves and with the primary dendrites.

As a consequence of this perfect fusion and of the subsequent transformation of the austenite, in the final structure it is not possible to distinguish between the primary and eutectic austenite. Theoretically, however, distinction is possible as the primary austenite generally is poorer in silicon, manganese and phosphorus. Boyles claims to have succeeded in differentiating between the two austenites by hot etching.

Solidification of hypereutectic alloys starts with the crystallization of large flakes of graphite. When the crystallization of the eutectic takes place these flakes continue to grow and there is generally no distinction between the pro-eutectic and eutectic graphite. There-

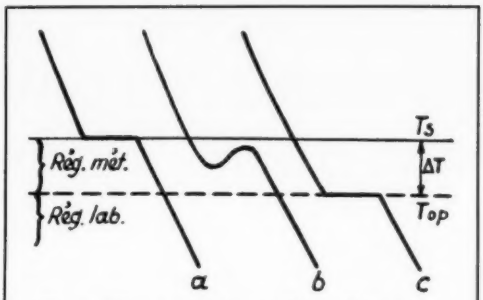


Fig. 3—Time-temperature solidification curves.

fore, the eutectic of gray iron does not show the characteristic structure known from the eutectics of numerous other alloys, and this peculiarity is the cause of the great difficulties encountered in studying the manner of graphite crystallization.

Graphite, or crystalline carbon, is a metalloid and it retains its proper aspect without allowing itself to be incorporated in an eutectic. Just as with the Al-Si eutectic, the Fe-graphite eutectic is particularly subject to the phenomenon of supercooling. This is sufficient to give an idea of the great varieties of structures and distribution of graphite, and but little is understood about them.

Classical Theory of Supercooling

In view of the great influence of supercooling on structure it is useful to summarize our knowledge of the phenomenon. Let us first examine the case of a pure metal or element. In the gaseous and liquid states the atoms are dispersed without order or symmetry. The solid or crystalline state (which is synonymous in the case of metals) is, on the contrary, a state in which the atoms are distributed in space according to a well determined law and characteristic of each element or compound.

Crystallization is a calling to order of the dispersed atoms about a center of crystallization. The crystallization center may be, and often is, a solid particle suspended in a liquid bath. It is evident (but often forgotten) that the ideal crystallization center is a solid particle belonging to the same crystal system as the metal which is to crystallize. It remains for the crystals of the metal only to set in an order already established.

According to the quantity of such suspended particles the metal crystallizes in large or small grains. Solidification will hardly be accompanied by apparent supercooling and the solidification graph will take the well known theoretical form (Fig. 3a) with the arrest at the temperature of the invariant crystal-liquid equilibrium. As a mater of fact, supercooling always takes place as its complete absence would necessarily correspond to a crystallization and cooling of infinitely small speed.

Consider the cast of the liquid being totally devoid of suspended particles. For the metal to crystallize it is necessary that centers of crystallization form. The centers form by the gathering of a small number of

atoms. We shall call these centers endogenous nuclei to distinguish them from suspended particles or extraneous nuclei.

Above the solidification temperature the atoms are in a state of thermal agitation and forces of repulsion predominate. If the temperature decreases and approaches the solidication point, the speed of the atoms decreases and the forces of repulsion diminish while the forces of attraction increase—the atoms show an increasing tendency to build fragments of their specific system.

At the beginning the fragments have but a short-lived existence, but as the temperature diminishes their stability increases and more and more are formed. However, before acquiring sufficient stability to attract and arrange in their system the atoms scattered in the liquid, it is necessary that the nuclei enter the metastable zone, i.e., a degree of supercooling $\triangle T$ is necessary (Fig. 3).

If the metal is shaken or subjected to certain external influences such as the passage of gaseous molecules, spontaneous crystallization (this without extraneous nuclei) always starts at T_s-$\triangle T$; in the absence of an external influence an even higher degree of supercooling is possible.

The two extreme cases may be summarized by the schematic and idealized graphs (Fig. 3a and b). Figure 3b represents an intermediate case, frequent in practice, which corresponds to an intermediate degree of supercooling.

One is tempted to consider the intermediate cases of supercooling as corresponding to the solidification of metals in which solid particles of a different system are suspended, the degree of supercooling being related to the degree of dissimilarity between the system of the metal and that of the particle.

Consider the crystallization of eutectics in relation to the phenomenon of supercooling. A eutectic is an intimate mixture formed by the simultaneous crystallization of two kinds of crystals which may be pure metals, saturated solid solutions or intermetallic compounds. Thus in Fig. 4, "E" shows the eutectic of the saturated solid solutions "C" and "D".

It is evident that two metals, A and B, or two solid solutions, C and D, or a metal and a solid solution, or a solid solution and an intermetallic compound, etc., as two constituents of the eutectic, generally present a different $\triangle T$ (Fig. 3). In other words, two phases have not the same tendency toward supercooling. This is particularly true when it is a case of metal-

TABLE 1—CRYSTAL SYSTEMS*

Cubic		Tetragonal	Orthorhombic	Hexagonal	Rhombohedral
Austenite			Cementite	Graphite	
CaO	CaS	TiO_2	$(FeO)_2SiO_5$	SiO_2	Al_2O_3
MgO	MgS	CaC_2	$(MnO)_2SiO_2$	FeS	$CaSi_2$
SrO	SrS	CrC_2	(FeO, MnO) SiO_2	SiC	
BaO	BaS	CeC_2			
MnO	MnS	LiC_2			
FeO	Li_2S	$ZrSiO_4$			
CeO_2	TiC				
Li_2O	ZrC				
TiN					
ZrN					

* Monoclinic and triclinic crystal systems, not being pertinent to the discussion, have been omitted.

metalloid system such as Al-Si, for instance, or (and this is of more interest here) such as Fe-graphite.

Thus, on account of the greater tendency of silicon to supercooling, it is possible, through a rapid cooling of the hypereutectic liquid "X" containing 14 per cent Si, to force a degree of supercooling (13 C) such as to obtain primary crystals of aluminum in the prolongation of the liquidus AE, although the eutectic when in equilibrium is at about 11.6 per cent Si.

Another important consideration to be taken into account is that of the crystal system of suspended particles. If this system is closer to that of constituent A than of B, it seems logical to suppose that it will inoculate a crystal A rather than B. It is surprising that technical literature does not seem to concern itself with the crystalline system of particles which happen to be suspended in liquid iron. However, a short study of the question leads to interesting observations.

To clarify matters, we should like to recall briefly the crystal systems (Table 1). The table also shows

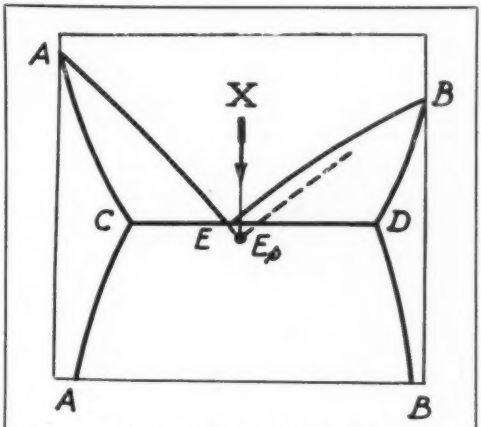


Fig. 4—Typical equilibrium diagram illustrating supercooling in an alloy of two metals which form a eutectic.

the crystal systems of austenite, cementite and graphite, and some compounds which generally are solid at the temperature of the cast iron eutectic and which can be present in suspension in cast iron either as a consequence of the melting itself or as a result of manipulations or additions of deoxidizing or inoculating materials.

Lamellar and Nodular Tendency Graphite

Let us consider a normal cast iron (C, 3.2 per cent; Si, 2 per cent) produced in the cupola. It contains small quantities of oxygen in the form of dissolved FeO. Pouring into the ladles and running into the sprue give rise to a mixing of the cast iron and oxide-slag, and the FeO content in the cast iron increases. As the latter contains a reducer in amply sufficient quantities, silicon among others, the latter acts as follows:

$$2\,FeO + Si \rightleftarrows Si\,O_2 + 2\,Fe + 66\ Kcal.$$

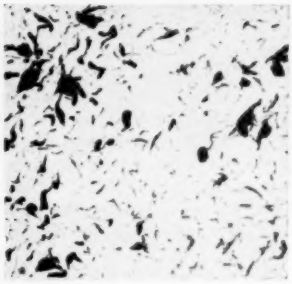


Fig. 5—Graphite structure of a cupola-melted cast iron: C, 3.6; Si, 1.1; Mn, 0.64 per cent. Tensile strength, 40,400 psi. Bhn, 203. X30.

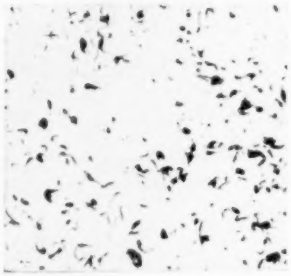


Fig. 6—Induction-furnace-melted cast iron (80 per cent hematite, 20 per cent mild steel). C, 3.4; Si, 1.25; Mn, 0.45; per cent. Tensile strength, 46,600 psi. Bhn, 197.

Fig. 7—Graphite structure of cast iron melted in an induction furnace. C, 3.28; Si, 1.1; Mn, 0.40 per cent. Tensile strength, 56,000 psi. Bhn, 197.

In applying the Law of Mass Action the condition of equilibrium can be deduced:

$$K_{Si} = \frac{[FeO]^2\,[Si]}{[SiO_2]}$$

The temperature function

$$\log K_{Si} = \frac{-11{,}106}{T} + 4.50$$

decreases with a fall of temperature. With cooling the reaction moves from left to right, hexagonal particles of SiO_2 are formed in the cast iron, and these particles act as crystallization nuclei of hexagonal graphite from the liquid phase.

Addition of aluminum gives rise to trigonal inclusions of alumina. The graphitizing power of aluminum is well known, and it seems that small additions alone help lamellar graphitization.

In another field, aluminum-deoxidized molybdenum steels after prolonged heating at 420-500 C have shown a formation of graphite.

The lamellar form of the graphite does not at all increase the tensile strength of cast iron; indeed, each lamella constitutes a discontinuity which can be compared to a notch in the metallic material. The influence of this notch will be more acute the sharper it is, i.e., the thinner and longer the graphite lamella.

A pearlitic cast iron of normal structure, i. e., with lamellar graphite as shown on the micrograph of Fig. 2, will hardly have a tensile strength 35,500 psi if the carbon content is 3.2 per cent. If the carbon content increases to 3.4-3.6 per cent, the tensile strength will decrease to 26,600-28,400 psi.

If nodular tendency graphite is obtained through an appropriate inoculation treatment, i.e., graphite in broad, large flake formation, as often occurs in hypereutectic irons, a tensile strength of 42,600 psi is readily attained with a carbon content of about 3.5 per cent.

Figure 5 shows the graphite structure of a cupola-melted cast iron with a tensile strength of 40,400 psi and carbon content of 3.6 per cent.

The nodular tendency is even stronger in the micrographs of Figs. 6 and 7, which show the graphite in cast irons produced in a high-frequency induction furnace from 80 per cent hematite pig and 20 per cent mild steel.

It should be pointed out that superheating was avoided during melting in the induction furnace; 1400 C was the maximum temperature attained, and pouring took place at about 1350 C in dried molds.

Supercooled Graphite

As stated previously, the partial or total elimination of nuclei influences the crystallization of graphite far more than that of austenite. Thus, when in the course of cooling and in the absence of graphite nuclei the liquid phase of a hypoeutectic alloy reaches the eutectic point at which the graphite theoretically should crystallize, austenite crystals continue depositing without simultaneous crystallization of graphite.

As a consequence, the primary austenite dendrites are more developed than in a normal structure cast iron of the same composition, and the liquid phase which will eventually form graphite contains more carbon.

Normal graphite structure and supercooled graphite structure for two cast irons of the same composition are shown in Figs. 8 and 9, respectively. Figure 9 shows a characteristic appearance of the eutectic which surrounds the primary austenite dendrites.

It is known that supercooled graphite can be obtained by rapid cooling, by superheating, and by treatment with titanium and carbon dioxide. It seems that the supercooling phenomenon is due to the lack of adequate nuclei or to their ineffectiveness in the case of very rapid cooling.

Supercooling Hypereutectic Alloys

Considering in general the phenomenon of supercooling of hypoeutectic alloys, two cases, shown schematically by Fig. 10a and 10b, can arise:

In the first case primary dendrites are deposited according to their supercooling curve, and this goes on until the supercooled eutectic deposits at the intersection point of the two supercooling curves (this eutectic generally is not of the same concentration as the equilibrium eutectic). In the second case, the primary dendrites are deposited according to the liquidus and to its prolongation until it reaches the supercooling

curve of the second phase; the latter then deposits and the point showing the liquid phase is displaced along the supercooling curve up to the supercooling eutectic point.

From the appearance of the supercooling eutectic it seems that the latter is at first an austnite-Fe_3C eutectic, and that consequently the supercooled graphite comes from the decomposition of the eutectic cementite immediately after solidification. This is the opinion which generally prevails and we consider it as at least highly probable.

The production of supercooled graphite by titanium treatment and bubbling of carbon dioxide was studied by Norbury and Morgan[2] among others, under the auspices of the British Cast Iron Research Association. After their researches, the authors developed a theory which can be summarized as follows:

"The Ti-CO_2 treatment produces inclusions of liquid titanates; the result is an absence of nuclei and the production of fine supercooled graphite."

According to the same authors, additions of Fe-Si, Fe-Si-Ca, Al, etc., produce solid inclusions such as silicates, CaC_2 and Al_2O_3, all considered as nuclei for graphite and giving rise to its crystallization in thick lamellae.

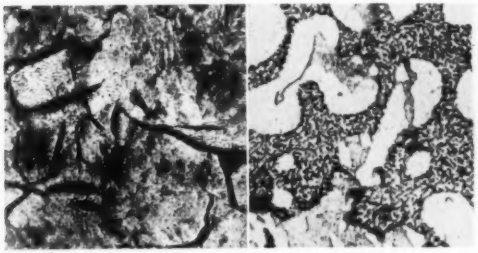
In this connection, we would also refer to Von Keil's theory[3]. This author considers inclusions of silicate sediments as graphite inoculants and as responsible for the normal crystallization of this element; superheating has the effect of liquifying and consequently of eliminating them by ascending precipitation.

Von Keil's theory being previous to Norbury and Morgan, the latter have endeavored to reconcile their point of view, in the case of the Ti-CO_2 treatment, with Von Keil's suspended silicate sediments in supposing that the latter (hereditary) suspensions are liquified by dissolving into the titanates.

A short study of this problem shows that the theories of Norbury-Morgan and of Von Keil have no real foundation; the most that can be said of them is that they are hypotheses which explain, very imperfectly, certain phenomena and do not explain at all other phenomena just as important, such as the inoculating effects of Fe-Si-Ca, Fe-Si, etc.

This leads us to refer to a theory which has, unfortunately, influenced research workers for many years —Piwowarsky's theory of graphite nuclei. This author claims that graphite is inoculated by particles of the same element suspended in liquid iron; superheating (1500 C) or being subjected for some time to an intermediate temperature (1400 C) causes their complete dissolution and, therefore, supercooling. This theory was definitely disproved when it was shown (by Piwowarsky himself and others) that graphite dissolves very rapidly in cast iron at temperatures slightly above the liquidus.

Figs. 8 (left) and 9 (right)—Normal graphite structure and supercooled graphite structure, respectively, of two cast irons of same composition.



The last theoretical contribution we shall mention is that of Eash[4], who suggests that the graphitizing effect of additions of Fe-Si is due to decreased carbon

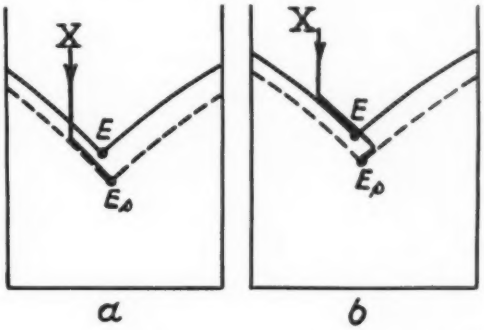


Fig. 10 (a, b)—Schematic drawing showing two possible conditions in the supercooling of hypoeutectic alloys.

solubility momentarily occurring around the silicon particles in the process of dissolution; the consequence of this is to render the liquid surrounding the dissolving particle hypereutectic and to cause the precipitation of primary graphite which acts as a nucleus.

Primary Graphite

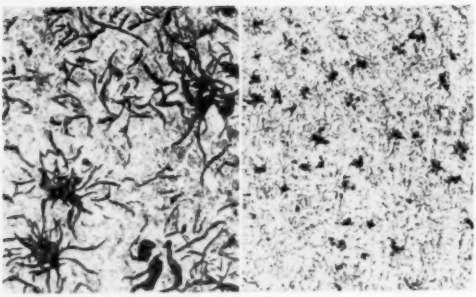
Eash's theory calls for the following remark: between the time of the addition and that of the solidification of the iron a sufficiently long time generally elapses to allow the homogenization of the liquid phase and the redissolution of primary graphite which might have formed, according to Eash's hypothesis. Indeed, let us not lose sight of the fact that graphite dissolves rapidly in liquid iron and that, at the time the graphitizing elements are added, the temperature of the iron exceeds that of solidification by some 100 to 250 C.

It may be logically assumed that supercooled graphite results from the decomposition of Fe_3C after solidification of the eutectic. According to this hypothesis, no graphite is formed directly from the liquid. This corresponds to the absence or ineffectiveness of nuclei of the hexagonal system.

The formation of supercooled graphite by additions of titanium and CO_2 can be explained by the formation of TiC, TiN and TiO_2 which crystallize in the cubic and tetragonal systems.

The affinity of titanium for oxygen being stronger than that of silicon, the former fixes the oxygen and prevents the formation of hexagonal particles of SiO_2.

Formation of supercooled graphite by superheating may be considered as a result of a higher degree of



Figs. 11 (left) and 12 (right)—Nodular graphite in hypereutectic gray cast iron. X200 and X50, respectively.

oxidation of the iron either as a result of addition of steel or, at all events, of the increasing solubility of FeO as the temperature rises.

A high degree of oxidation is favorable to the formation of metallic silicates as products of deoxidization by silicon at the time of the cooling. Indeed, $(FeO)_2SiO_2$ $(FeO\text{-}MnO)SiO_2$ and $(MnO)_2SiO_2$ crystallize in the orthorhombic system and are specific nuclei for Fe_3C and secondarily for austenite.

The absence of lamellar graphite in an iron of normal composition but cooled very rapidly can be explained by the lack of nuclei of the hexagonal system. It should be remembered, however, that the formation of graphite lamellae results from a phenomenon which is accompanied by an increase in volume, and that the growing lamella must overcome the pressure of the liquid; this is quite possible but takes some time.

The crystallization of the liquid phase itself, on the contrary, is accompanied by a shrinkage, and the linear speed of growth of the crystals is not decreased by the pressure factor.

Graphite being far more subject to supercooling than the metallic phase itself, it is possible to force the supercooled graphite to form flakes in the presence of specific nuclei by extremely rapid cooling. Such is the case for the specific nucleus when rendered ineffective by conditions promoting very rapid solidification.

Nodular Graphite

Is it necessary to demonstrate that nodular graphite represents the least harmful form of this element of discontinuity? A nodule is practically a sphere, and the latter represents the minimum surface for a given volume as well as that which, as far as discontinuity is concerned, ensures the most regular distribution of stresses in the matrix. Thus, a nodule corresponds to the minimum notch effect for a given mass of graphite.

The possibility of forming nodular graphite as a structural element as-cast is established. Hanemann and Schrader show the occurrence of nodular graphite in hypereutectic cast irons for piston rings (Fig. 11).

One finds that the nodules are at the center of eutectic cells. The cast iron illustrated by the micrograph of Fig. 11 is hypereutectic (C, 3.73 per cent; Si, 2.23 per cent; Mn, 0.75 per cent; P, 0.46 per cent; S, 0.05 per cent) and cooled rapidly (section 3x3 mm).

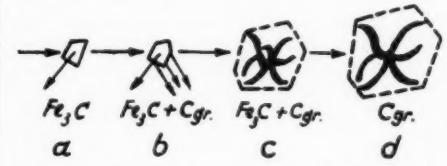


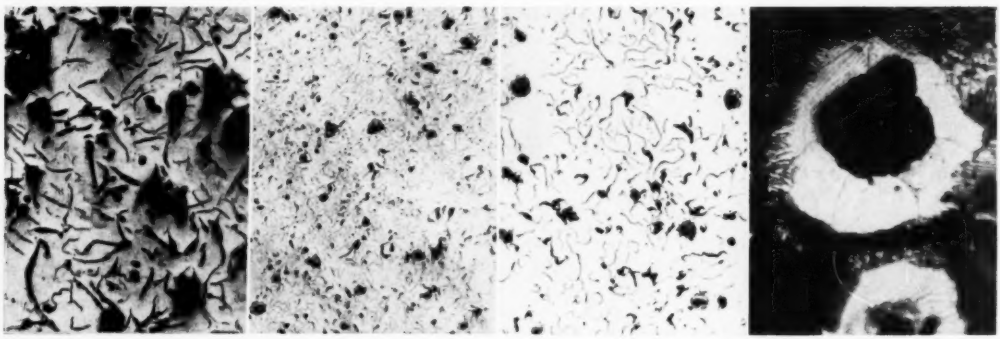
Fig. 13—Schematic representation of the precipitation and decomposition of iron carbide.

This example is not exceptional. It seems that, without special additions, the two condition, hypereutectic composition and rapid cooling, must be observed simultaneously to obtain as-cast nodular graphite.

In examining Figs. 11 and 12 one finds that each nodule of graphite is at the center of a eutectic cell and is surrounded by a crown of lamellae. Hanemann infers from this that the graphite nodule is of primary

Figs. 14 to 17—Photomicrographs showing graphite structures of cast irons containing approximately 2 per cent Si and 3.6 per cent C, and inoculated to force crystallization of nodular graphite. Fig. 17 shows a spherulite of graphite surrounded by a ferritic or decarburized ring. The matrix is completely pearlitic.

Fig. 14 X60 **Fig. 15 X100** **Fig. 16 X300** **Fig. 17 X800**



crystallization and is formed from the liquid, and that the surrounding lamellae are produced by the eutectic crystallization in the course of which the lamellae are implanted on the existing nodules.

One wonders, however, why the graphite of primary crystallization should lose its lenticular appearance whereas in the course of the further crystallization of the eutectic—in a more viscous medium—this appearance is maintained. Also, does not kish graphite present itself under the form of scales?

Hanemann's point of view corroborates that of Eash who says: "The addition of a silicon-base inoculant produces a hypereutectic composition locally, whereupon there is a precipitation of the graphite nodule on which the lamellae are implanted during later crystallization." The same remark applies to the appearance of the graphite.

Would it not be logical to consider nodular graphite as a product of the decomposition of cementite? We are of the opinion that when a hypereutectic iron is cooled rapidly, the solidification starts by the crystallization of primary cementite, the decomposition of which may be started but ends only after complete solidification. At the same time the eutectic cell develops around the decomposing cementite nucleus and the austenite-lamellar graphite eutectic gives graphite which varies in size directly with the cell sizes.

If the solidification of the hypereutectic iron is not rapid, the nodules do not form; in this case, the cementite decomposes in the liquid phase and gives rise to lamellar graphite (Fig. 13). In other words, it seems that in order to obtain nodular graphite, it is necessary that the two following conditions be observed: precipitation of Fe_3C, and decomposition of this carbide toward the end of or even after solidification of the eutectic. In the case of an ordinary hypereutectic cast iron, however, it is not possible to obtain all the graphite in the nodular state; the eutectic crystallization gives rise to lamellar graphite.

It is highly probable that the crystallization of the graphite in lamellae is connected with the presence of hexagonal nuclei suspended in the metal; we have mentioned SiO_2, a product of the deoxidation of iron on cooling. According to this hypothesis, it seems that an addition of certain products based on deoxidizers more powerful than silicon must favor the formation of nodular graphite or, what amounts to the same thing, avoid the lamellar crystallization of the graphite.

Furthermore, it is evident that these deoxidizing elements may not give rise to the formation of compounds (oxides, carbides, nitrides) which crystallize in the hexagonal (or even ternary) system and which precipitate in the solid state above the eutectic temperature.

These conditions are met by several elements, the oxides, and even the carbides and some nitrides, of which crystallize in the cubic or tetragonal system (Table I) and act as nuclei of the austenite and subsidiarily of the carbides, thus favoring the formation of nodular graphite from Fe_3C or even from complex carbides (Figs. 14 to 21). Among the elements considered, we shall content ourselves with: Mg, Li, Ba, Ca, Sr, V, Ce, Ti, etc.

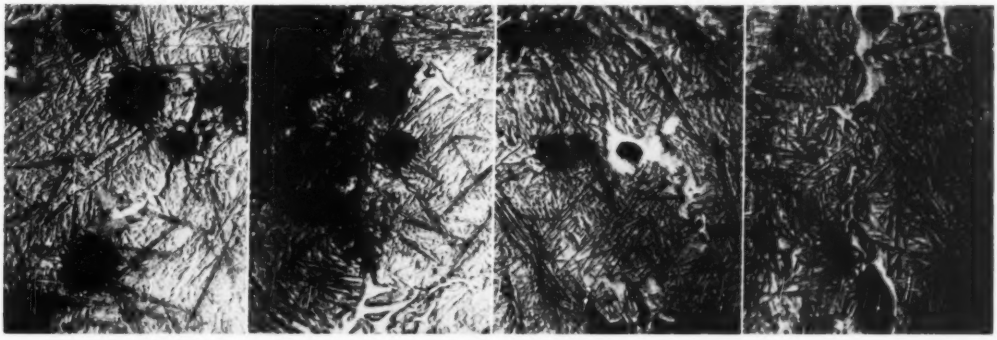


Fig. 18 X800 Fig. 19 X800 Fig. 20 X800 Fig. 21 X800

Figs. 18 to 21—Martensitic cast iron of composition: C, 3.35; Mo, 0.95; Si, 1.77; P, 0.09; Ni, 1.25; S, 0.04 per cent. Figs. 18 and 19 show non-graphitic heart of spherulites. All graphite appears in form of nodules and masses. Figs. 20 and 21 show the intermediate state of the transformation of cementite into graphite.

The interesting studies of H. Morrogh and W. J. Williams [5,6] seem to confirm our hypotheses; these authors have obtained nodular (and even spherulitic) graphite in nickel-carbon and cobalt-carbon alloys by addition of calcium or magnesium[5]; in actual cast irons, the same authors have obtained nodular graphite by using another element of the series characterized above, namely, cerium[6]. It should be noted, however, that the production of nodular graphite by cerium addition is possible only under certain conditions, principal of which are a very low sulphur content and a hypereutectic cast iron composition.

It is hardly possible to explain the influence of the sulphur, which seems to be very important. Notwithstanding that FeS crystallizes in the hexagonal system, it is hardly possible to consider this compound as a nucleus of lamellar graphite, as the solidification temperature of the Fe-FeS eutectic is only 985 C. A primary precipitation of FeS between 1200 C and 1150 C

would be possible only if there were a local concentration of some 35 per cent of sulphur.

On the other hand, the crystal system of Ce_2S_3 is not known, and it also is probable that the melting point of this compound is lower than 1145 C; the compounds CeO_2 and CeC_2 are cubic and tetragonal.

In order to obtain a first and brief verification of the hypothesis of the influence of the crystal system of nuclei, a series of orientation tests have been made during the past year; a systematic study of the whole question is to start shortly.

In the way of additions to force the crystallization of nodular graphite, several elements of the series: Mg, Li, Ba, Sr, V, Ce and Ti were used individually or mixed.

Most of the melting operations (11 to 33 lb of iron) were carried out in induction furnaces with hematite pig (S, 0.04 per cent and P, 0.1 per cent) and basic Bessemer steel scrap in the charge. In the great majority of cases, a mixture of sperulitic graphite, nodular graphite (often malformed mass) and lamellar graphite was obtained.

Micrographs in Figs. 14, 15 and 16 show three aspects of the graphite structure of cast irons (containing about 2 per cent Si and 3.6 per cent C) treated with one of the above mentioned elements.

Figure 17 shows a spherulite of graphite surrounded by a ferritic or decarburated ring; the matrix is entirely pearlitic. It is interesting to note that the heart of the spherulite consists of a non-graphitic nucleus (this is general) and that the spherulite grows radially from the center. The micrographs of Figs. 18 to 21 illustrate the non-graphitic heart of the spherulites.

The last four micrographs are concerned with a martensitic cast iron, the analysis of which is as follows: C, 3.35 per cent; Mo, 0.95 per cent; Si, 1.77 per cent; P, 0.09 per cent; Ni, 1.25 per cent; and S, 0.04 per cent.

All of the graphite appears in the form of nodules and masses (Figs. 18 and 19). The transformation of cementite into graphite is incomplete and the intermediate state appears clearly in Figs. 20 and 21; the spherulites develop from a center situated inside the cementite.

In conclusion, the author believes that the crystal system of solid particles suspended in the iron probably determines the form of the graphite. Our orientation tests are insufficient and cannot be considered as a scientific proof of the hypothesis; they constitute but a favorable argument.

The question deserves to be studied methodically, and we hope to have the opportunity of doing it.

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6. H. Morrogh and W. J. Williams, *Journal*, Iron and Steel Institute, (1948) p. 306.

CAN YOU IDENTIFY THESE OLDTIMERS?

Some of the foundrymen shown in this photograph taken at an American Foundrymen's Association Convention around the turn of the century will be present at the 1949 A.F.S. Convention in St. Louis, May 2-5, to sign the A.F.S. Honor Roll and to add to their collection of 25 and 50-year buttons. Included in this picture are several Past National Presidents and foundrymen whose names have long been prominent in the industry. How many of them can you identify? Where and when was the photograph taken? Mail your answers to the Editor, AMERICAN FOUNDRYMAN, *222 West Adams St., Chicago 6, Ill.*

Questions THE ROUND TABLE Answers

Increase Chill With Tellurium

Please send us any information you can on the use of tellurium in cast iron.

Tellurium is an extremely powerful carbide stabilizer, concentrations as low as 0.004 per cent having a very noticeable influence on the depth of chill. It is especially useful when a small quantity of chilled castings is desired but the foundry normally produces iron of a composition which casts entirely gray. Because of its potency, extreme care must be exercised in the use of tellurium. A quantity in excess of the absolute minimum necessary to accomplish the desired result will yield a casting in which the gray portions will contain a network of iron carbide. As a consequence the casting will be brittle and difficult to machine.

Tellurium is added by introducing an accurately weighed quantity into a ladle containing a cushion of molten iron. Additional molten iron is then immediately added for agitation and to thoroughly dissolve the tellurium. Tablets containing definite quantities of tellurium can be obtained from producers of non-ferrous metals. As a trial, we suggest that you try the proportion of two to four grams of tellurium to 1000 lb of molten iron.

Some information on the use and effect of tellurium on iron, and preferred methods of adding alloys, are contained in the A.F.S. publication ALLOY CAST IRONS HANDBOOK. Using tellurium core washes to induce mild chilling action is described in *"Preventing Shrinkage in Gray Iron Castings,"* AMERICAN FOUNDRYMAN, August 1947, page 26.

Tellurium added to molten iron liberates fumes which, if inhaled, may cause a person to develop a breath with a distinct garlic odor. Therefore, the tellurium should be added to the ladle at a point which is adequately ventilated, preferably with an exhaust hood. Careful studies show that absorption of small quantities of tellurium fumes by inhalation is not detrimental to health.

What Iron For Permanent Molds?

Can you give us information on cast iron such as is used in the manufacture of permanent molds?

Cast iron in this type of service is subjected to drastic temperature gradients, the surface of the mold being heated to a relatively high temperature while the outside of the mold may still be at room temperature. These temperature differences with their attendant high expansion in the surface of the mold, cause stresses which at times may be in excess of the ultimate strength of the material. This causes superficial failure of the mold and produces typical "fire cracks" which start very small but progressively enlarge until the mold must be discarded due to the objectionable imprint of the cracks on the castings.

Since the stress developed is a function of the extent of the differential expansion and the modulus of elasticity of the metal, and it is only the latter which can be controlled, it is necessary that the iron selected for a permanent mold have a low modulus, approximately 10 to 12 million psi. Such an iron would have a high total carbon content— 3.75 to 3.80 per cent —with good graphite distribution and would contain a minimum of eutectiform graphite. The silicon and other graphitizing elements should be controlled so as to avoid free primary carbides.

Wants Non-destructive Test Methods

We are in search of information on non-destructive methods for testing castings for internal defects.

Three methods available are: use of x-rays or gamma-rays; magnetic particle and fluorescent methods; and supersonic methods. The latter are relatively new and have not been widely adopted because it is impossible by present methods to establish the size of the defect.

Magnetic particle and either x-ray or gamma-ray inspection are rather widely used in the examination of steel castings, less commonly for the other ferrous castings. Magnetic particle inspection, of course, is not applicable to the non-magnetic alloys (brass, bronze, aluminum, magnesium, etc.) and castings of such alloys must be examined by fluorescent methods or by x-rays or gamma-rays. In general, magnetic particle and fluorescent inspection are used to find defects which extend to the surface such as fine cracks not discernible to the naked eye. Under some conditions sub-surface defects very close to the skin of the casting can be disclosed by these methods. Inspection by x-ray and gamma-ray is used to find and evaluate internal defects of all sizes down to a small fraction of a per cent of the thickness of the section under examination.

Inspection and its application in foundry control was covered thoroughly in the Annual Lecture Series at the 1948 Annual A.F.S. Convention. First lecture to be published, on steel foundry control methods, appears in this issue of AMERICAN FOUNDRYMAN, page 38. Subsequent issues will contain papers on foundry control methods for gray iron, malleable iron, brass and bronze, and magnesium and aluminum.

FEF OUTLINES STUDENT PROGRAM

RECOMMENDATIONS TO UNIVERSITIES and engineering students from the Foundry Educational Foundation's Technical Advisory Committee are expected to help schools develop foundry courses and to aid students in their studies. The Foundation, which has just completed its first year of a three-year program, is providing scholarships and supplementary assistance to six outstanding engineering schools—Massachusetts Institute of Technology, Case Institute of Technology, Cornell University, the University of Wisconsin, Northwestern University, and the University of Cincinnati. In addition, FEF is assisting in the placement of engineering students in summer foundry jobs and in placing graduates.

With reference to the items enumerated below, the Technical Advisory Committee recommends that:

Specifications—(1) The specifications and procedures set forth by the American Society for Testing Materials be adopted as the most acceptable for foundry educational purposes. (2) ASTM specifications take precedence over all others where any conflict exists.

Sources of Data—Procedures not covered by ASTM be adopted from the following source material: CAST METALS HANDBOOK, CUPOLA OPERATIONS HANDBOOK, MODERN CORE PRACTICES AND THEORIES, RECOMMENDED PRACTICES FOR THE SAND CASTING OF NON-FERROUS ALLOYS, ALLOY CAST IRONS HANDBOOK, GATING TERMINOLOGY CHART, all publications of the American Foundrymen's Society; *Aluminum Foundry Process Control*, Society of Automotive Engineers; *American Malleable Iron*, Malleable Founders' Society; *Steel Castings Handbook*, Steel Founders' Society.

Societies Supply Information

Other Sources of Data—Specific procedures other than those contained in the references above are to be obtained by direct inquiry to the proper society. It is suggested that each society prepare detailed information for educational purposes, including casting of test specimens, and supply same to inquiring universities. Inquiries would be addressed as follows:

Aluminum—American Foundrymen's Society, 222 West Adams St., Chicago 6.

Brass and Bronze—Brass and Bronze Ingot Institute, 308 W. Washington St., Chicago 6.

Gray Iron—Gray Iron Founders' Society, Inc., 1010 Public Square Building, Cleveland 13.

Magnesium—American Foundrymen's Society, 222 W. Adams St., Chicago 6.

Malleable Iron—Malleable Founders' Society, Union Commerce Building, Cleveland.

Steel—Steel Founders' Society of America, 920 Midland Building, Cleveland.

Terminology—Castings terminology to be aligned with the "Glossary" now being compiled by the American Foundrymen's Society. Until this is available and approved, the "Glossary" published by *The Foundry* is to be used.

Job Definitions for the castings industry shall be taken from the following reference material until such time as an up-to-date manual becomes available: THE FOUNDRY IS A GOOD PLACE TO WORK, and MILITARY ASSIGNMENTS RELATED TO THE FOUNDRY INDUSTRY, American Foundrymen's Society; such lists as are currently issued by Malleable, Gray Iron, Steel and Non-Ferrous Societies.

Sand Testing—(1) All students should be familiar with procedures outlined in the FOUNDRY SAND TESTING HANDBOOK; (2) Recommended procedures should be followed for beginning foundry courses; (3) Investigation and testing beyond the limitations of the handbook should be encouraged.

Chemical Analysis of foundry raw materials, supplies and products shall follow procedure as outlined by American Society for Testing Materials.

Pattern Identification—(1) Pattern colors and identification marks to be as detailed by STANDARD PATTERN COLORS CHART and correlated instructions, American Foundrymen's Society, Pattern Division; (2) Modifications should be adopted as issued by this division.

Reference Points—In all laboratory instruction and in engineering drawing classes, the student be required to identify proper reference points or lines for pattern, casting, inspection and machining layouts. Concurrently, instruction should advocate that such points shall be located on those surfaces of the casting which can be most readily maintained to close tolerance and most perfect finish during the casting operation.

Safety—Safe practices, such as those outlined by the National Safety Council, should be incorporated into all educational laboratory exercises where feasible.

Foundries, Safe Practices Pamphlet No. 13, and *Handling Material in Foundries*, Safety Instruction Card No. 485, National Safety Council, 20 North Wacker Drive, Chicago 6.

RECOMMENDED GOOD SAFETY PRACTICES FOR THE PROTECTION OF FOUNDRY WORKERS, American Foundrymen's Society.

Lecture Program—Each university should avail itself of a lecture program designed to give a well-rounded presentation over a three-year period. Some of these lectures would be of general engineering interest and others only to those studying for the casting and allied industries, the former lectures to be given by recommended speakers known to have the ability to speak in specific language and are authorities on their subject.

Some lecturers are to be recommended by the Technical Advisory Committee. Other lecture subjects will be specified but speakers left to local college choice with committee assistance (depending on area), and still others to be by local option alone.

The following is divided into fields to match the above plans:

(1) Specified lectures and lecturers:

Aluminum Castings Industry—Speaker to be announced.

Brass and Bronze Castings Industry—Speaker to be announced.

Gray Iron Castings Industry—George Johnstone, Johnstone Foundries.

Malleable Castings Industry—James H. Lansing, Malleable Founders' Society.

Steel Casting Industry—Charles W. Briggs, Steel Founders' Society of America.

Functions of the American Foundrymen's Society—S. C. Massari, American Foundrymen's Society.

Foundry Equipment and Engineering—A. W. Gregg, Whiting Corp.

(2) Specified lectures for which recommended speakers should be sought:

Molding Sand
Core Room Practice
Molding Methods
Mold Atmosphere
Mold Coatings
Inspection Methods
Casting Design
Pattern Design
Model Usage
Permanent Molding
Die Casting
Centrifugal Casting
Investment and Precision Casting
Cupola Operations
Direct Arc Furnaces
Indirect Arc Furnaces
Air Furnaces
Induction Furnaces
High Frequency Heating
Crucible Furnaces
Heat Treatment of Castings
Cost Control
Quality Control
Trimming and Cleaning
Refractories
Military and Engineering Test Procedure
Motion Study

Visitation Program—Students should make a series of foundry visits. These can be accomplished in conjunction with regular university class tours, through summer or co-op work, or as an individual endeavor. These are adjusted to provide a reasonably complete survey of all types of foundries. Local advisory committees can help effect this plan in co-operation with college authorities. Some of the following operations will show up in combination with other visits, and will reduce the actual number of trips accordingly.

Aluminum and Magnesium
- Sand
- Permanent Mold
- Die Casting
- Centrifugal

Brass and Bronze
- Sand
- Permanent Mold
- Die Casting
- Centrifugal
- Plumbing Goods
- Special Alloys

Gray Iron
- Mechanized
- Machinery
- Jobbing
- Pipe
- Automotive
- Centrifugal
- Chilled Iron
- Cupola
- Electric Furnace

Malleable
- Mechanized
- Automatic
- Jobbing
- Duplexing
- Air Furnace
- Continuous Anneal
- Period Anneal

Steel
- Mechanized
- Jobbing
- Open Hearth
- Electric Furnace
- Convertor
- High Frequency
- Extra Large (25 tons upward)

Specialty
- Precision Molding
- Art Work
- Piston Rings

Foundry Exhibit
- Museum of Science and Industry

One plant where the complete cycle of design to test floor can be observed.

In all of these visits the local advisory committee can assist the university staff by helping select representative foundries and in making arrangements where help is needed.

Completion of the above program will reveal to foundry students the scope of the industry both as to operation and products as well as to the customer industries it serves.

Research Projects and Thesis—(1) The program now being developed by the Research Project Committee of the Educational Division, American Foundrymen's Society, should be used as a guide for special laboratory exercise; (2) The projects outlined by this committee are subject to smaller division by the universities and should provide a guide to thesis subjects for graduate and undergraduate work.

Training Program—(1) Employers should provide for all students and graduates a two-year training program as a means of indoctrinating them with the present techniques of the industry. Improvement of the industry is expected and anticipated, but it cannot be soundly proposed without the graduate engineer understanding present practice.

(2) Company training programs now in effect may well satisfy the needs of this requirement. Where practical, companies are urged to make alterations which will bring them into line with the recommendations contained in "Foundry Training Courses for College Graduates," A.F.S. TRANSACTIONS, vol. 55, p. 200 (1947). Some rearrangement is anticipated to match company production processes when specialized departments are maintained.

Reference Books—Each student should acquire, over a period of time, the following books as a basic reference library for study and industrial use:

GENERAL
- *Metals Handbook*, ASM.
- CAST METALS HANDBOOK (3rd Ed.), A.F.S.
- CUPOLA OPERATIONS HANDBOOK (1st Ed.), A.F.S.
- FOUNDRY SAND TESTING HANDBOOK (5th Ed.), A.F.S.
- MODERN CORE PRACTICES AND THEORIES (2nd Ed.), A.F.S.
- CENTRIFUGAL CASTING, A.F.S.
- FOUNDRY COST METHODS, A.F.S.
- CLASSIFICATION OF FOUNDRY COST FACTORS, A.F.S.
- TRANSACTIONS, A.F.S. (annual issues).
- PERMANENT MOLD CASTINGS BIBLIOGRAPHY, A.F.S.
- *Foundry Process Control (Ferrous)* SAE.
- GATING TERMINOLOGY CHART (Discount on quantity lot), A.F.S.
- *Metal Castings*, Harry L. Campbell, John Wiley & Son, New York, 1936.
- *Metals & Plastics*, T. P. Hughes, Irwin-Farhham Publishing Co., Chicago, 1947.
- *Modern Foundry Practice*, Edited by E. D. Howard, Odham's Press, London, England, 1945.
- *Manual of Foundry Practice*, J. Laing and R. T. Rolfe, Chapman and Hall, London; and Chemical Publishing Co.
- *Foundry Work*, R. E. Wendt, McGraw-Hill Book Co., Inc., New York, 1942.
- *Foundry Work*, W. C. Stimpson, B. L. Gray and John Grennan, American Technical Society, Chicago, 1947.

GRAY IRON
- *Gray Cast Iron*, J. Bolton, Penton Publishing Co., Cleveland.
- ALLOY CAST IRON HANDBOOK (2nd Ed.), A.F.S.
- GRAPHITIZATION OF WHITE CAST IRON, A.F.S.

MALLEABLE
- *American Malleable Iron*, MFS.
- *Malleable Iron*, H. A. Schwartz, Penton Publishing Co.
- GATING AND HEADING MALLEABLE IRON CASTINGS, A.F.S.
- MALLEABLE FOUNDRY SAND AND CORE PRACTICE, A.F.S.
- MALLEABLE IRON MELTING, A.F.S.

NON-FERROUS
- RECOMMENDED PRACTICES FOR THE SAND CASTING OF NON-FERROUS ALLOYS (1st Ed.), A.F.S.
- *Aluminum Foundry Process Control*, SAE.
- *Non-Ferrous Foundry Practice*, J. Laing and R. T. Rolfe, Chapman and Hall, Ltd., London, and D. Van Nostrand, New York, 1940.

STEEL
- *Steel Castings Handbook*, SFS of A.

PATTERNS
- *Wood Pattern Making*, Herbert J. McCaslin, McGraw-Hill Book Co., Inc., New York.
- *Pattern Making*, James Ritchey, Walter Monroe, C. W. Beese and P. R. Hall, American Technical Society, Chicago, 1946.

MIT IS HOST TO NEW ENGLAND CONFERENCE

APPROXIMATELY 400 FOUNDRYMEN attended the Annual New England Foundry Conference, October 22 and 23, at the Massachusetts Institute of Technology, where the largest lecture hall was given over to the two-day technical sessions. MIT has been host to the conference annually since its inception eight years ago. In addition to the extensive technical sessions, highlights of the conference were the annual Lumen S. Brown Lecture, given this year by Dr. Ralph L. Lee, General Motors Corp., Detroit, the conference dinner, a tour of MIT's foundry facilities, and the yearly supplymen's dinner given for the conferences at the Parker House, Boston.

The conference was sponsored jointly by the New England Foundrymen's Association, American Foundrymen's Society, Connecticut Foundrymen's Association, Connecticut Non-Ferrous Foundrymen's Association, Non-Ferrous Founders' Society, and the Massachusetts Institute of Technology. David L. Parker of the General Electric Co., Everett, Mass., was conference chairman, with A. F. Dockry, H & B American Machine Co., vice-chairman; and C. A. Wyatt, Debevoise-Anderson Co., Boston, registration chairman.

Opening the conference, Dr. Thomas K. Sherwood, dean of engineering, welcomed the foundrymen on behalf of MIT, stating that since the Institute has been chosen as one of the Foundry Educational Foundation schools, he felt that its tie with the foundry industry is particularly strong.

Following the address of welcome, the first technical session, devoted to patterns, convened under the chairmanship of T. F. Worth, General Electric Co. F. Schumacher of the Cooper Alloy Foundry Co., Hillside, N. J., spoke on *"Plastic Patterns,"* in which he cited methods and materials used in the making of plastic patterns, and discussed their economic advantages over other pattern types.

O. A. Carlson, Carlson Pattern Shop, Springfield, Mass., illustrated a talk on *"Pressure Casting of Aluminum Matchplates"* with a color motion picture showing various stages in the production of matchplates.

Following a brief luncheon recess, E. H. Ballard, a Past National President and Gold Medalist of A.F.S., introduced this year's Lumen S. Brown Lecturer, Dr. Ralph L. Lee, who spoke on *"Humanics in the Foundry."* Based upon the speakers' extensive experiences in personnel work, Dr. Lee's lecture was an outstanding feature of the conference.

Following the Brown Lecture, Henry G. Stenberg, Draper Corp., Hopedale, Mass., presided at the afternoon technical session and introduced the first speaker, L. P. Robinson, Werner G. Smith Co., Cleveland.

Mr. Robinson's address, *"Cost Reduction Practice in the Core Room,"* outlined the many variables that affect coremaking practices and the effect these variables have upon coreroom economies, unless controlled. Use of wet core sands, inaccurate weighing and measuring of materials, and failure to measure temperature by a pyrometer were a few of the practices cited by Mr. Robinson as contributing to bad coremaking.

The final speaker of the first day's sessions, J. S. Vanick, International Nickel Co., New York, in an address on *"The Foundry Industry of the Future,"* compared current production volumes of the various types of metal castings and outlined ways in which foundry mechanization can help to improve output. Research, according to Mr. Vanick, is paving the way for many new production techniques that will eventually lead to better and cheaper castings.

About 150 foundrymen attended the annual conference dinner at MIT's Graduate House, where Arthur F. Dockry, president of the New England Foundrymen's Association and conference vice-chairman, presided and introduced the speakers: A.F.S. National President W. B. Wallis; Dr. John Chipman, head of MIT's department of metallurgy; and R. F. Harrington. Hunt-Spiller Manufacturing Corp., South Boston.

Mr. Harrington, chairman of the Friday morning technical session, introduced R. F. Tibolt, Mystic Iron Works, Boston, who spoke on *"Pig Iron—Future Supplies,"* in which he stated that an abundance of pig iron will not be available for a long time because of a present high demand, but while the Lake Superior district output is decreasing, it is believed that the discovery of new iron ore deposits in Labrador may ease the shortage somewhat.

Cast Iron Produced Under Present Conditions

R. G. McElwee of the Vanadium Corporation of America, Detroit, speaking on *"Production of Cast Iron—Making the Most of What Is Available,"* recommended the use of higher carbon irons for sounder castings and better machineability. This can be accomplished, Mr. McElwee said, by melting a lower silicon iron in the cupola, then adding silicon or other inoculants to the ladle to bring the silicon to the desired amount in the casting. The speaker cited the need for study of slags and attention to the results of chemical analyses.

At the final technical session on Saturday afternoon, the speakers were A. H. Hesse of R. Lavin & Sons, Chicago, and Prof. Howard Taylor of MIT. Walter M. Saunders, Jr., of Providence, R.I., was chairman.

Mr. Hesse called attention to the need for studying directional solidification in bronze castings, and proper deoxidation of melt by the use of phosphorous or zinc. He listed data indicating that super-heating a melt of bronze to an optimum temperature and cooling to proper pouring temperature results in considerable increase in tensile strength and elongation.

The Foundry Educational Foundation at the Massachusetts Institute of Technology was described by Professor Taylor, who told of many instances proving the enthusiasm of students for foundry courses. Professor Taylor cautioned foundrymen not to expect a graduate of the course to know all the practical details of foundry operation. MIT, he said, like other schools, stresses fundamental training in the sciences and many foundry techniques must be learned after graduation, or during summer vacations.

Professor Taylor then invited foundrymen present to inspect MIT's foundry. Members of the MIT Student Chapter of A.F.S. acted as guides during a tour of the Institute's extensive foundry facilities.

WHO'S WHO

A. L. De Sy

Albert L. DeSy, author of *"Belgian Research Advances Nodular Graphite Theory"*, Page 55, is head of the Metallurgy Department of the University of Ghent, Belgium, and one of that nation's best-known authorities on metallurgy . . . Has authored three well-known textbooks on metallurgy in French . . . Holds a degree in Mining Engineering from the University of Ghent (1933), and prior to returning to that institution in 1935 as an assistant professor, Dr. DeSy, worked in Czechoslovakia for a year, and was with a foundry in Ghent . . . In 1940, Dr. DeSy was appointed head of the University's Metallurgical Department.

J. W. Juppenlatz

J. W. Juppenlatz, author of *"Quality Control Review . . . Summarize Test Procedures for Steel Foundrymen"*, Page 38 was one of five men chosen to deliver the Annual Lecture Series at the 1948 A.F.S. Convention, Philadelphia . . . Mr. Juppenlatz, after attending the Massachusetts Institute of Technology, joined Chapman Valve Mfg. Co., Springfield, Mass., as chief metallurgist in 1921 . . . Since 1942, Mr. Juppenlatz has been chief metallurgist, Lebanon Steel Foundry, Lebanon, Pa. . . . A member of the A.F.S Steel Division, Mr. Juppenlatz is associated with the Committee on Non-Destructive Testing.

H. W. Bennett

H. William Bennett, author of the first of a series of articles appearing in AMERICAN FOUNDRYMAN on unusual foundry operations and techniques, *"Modern Foundry Methods"*, Page 52, is foundry apprentice supervisor for Canada's Dominion Engineering Works, Lachine, Que. . . . Mr. Bennett served his apprenticeship as a molder at Robert Mitchell Co., Ltd., Montreal, and W. R. Cuthbert, Ltd., Montreal, in the early 1900's . . . He later became bronze foundry superintendent for Jenkins Bros., Ltd., Montreal, from 1908 to 1910, before returning to Robert Mitchell Co., Ltd., in the same capacity for two years. . . Mr. Bennett resigned his position there to again become bronze foundry superintendent for Jenkins Bros., Ltd., a position he held until 1926 . . . That year, Mr. Bennett joined T. McAvity & Sons, Ltd., St. John, New Brunswick, in the same position, remaining there until 1930.

J. B. Caine

John B. Caine, author of *"Foundry Career Opportunities"*, Page 49, is a member of the Executive Committee of the A.F.S. Sand Division and is well-known to foundrymen for his frequent appearances as a technical speaker and for his many writings for the technical press . . . Mr. Caine attended the University of Cincinnati and the Case Institute of Technology, before serving a two-year apprenticeship at Interstate Foundries, Cleveland, in 1924-25 . . . Following this, Mr. Caine was appointed metallurgist for the Matthews Steel Castings Co., Cleveland . . . In 1932, Mr. Caine left Matthews to accept his present position as metallurgist with Sawbrook Steel Castings Co., Cleveland . . . A member of A.F.S., SFSA, ASM and the British Iron and Steel Institute, Mr. Caine was chairman of the Cincinnati District chapter of A.F.S. in 1940.

L. B. Knight

Lester B. Knight, whose *"Eighteen Days Behind the Iron Curtain"*, Page 28, is the story of his travels in Eastern Europe as A.F.S. representative to the International Foundry Congress, is president of his own firm of consulting engineers, Lester B. Knight & Associates, Chicago . . . Mr. Knight, a graduate of Cornell University in 1929, worked with Dr. H. Ries, then head of the Geology Department, on A.F.S. sand research projects . . . Upon graduation, he joined the Illinois Clay Products Co. as sales engineer, and a year later became associated with the National Engineering Co., Chicago, in the same capacity . . . He had successively become sales manager and vice-president of National Engineering by 1943, when the Navy called him to Washington as a lieutenant commander to assist in the completion of its foundry and MM forge program . . . At war's end, Mr. Knight established his own consulting engineering organization. . . . Long an active member of A.F.S., he has been a frequent speaker of national, regional and chapter meetings on sand preparation, foundry modernization and good housekeeping.

A. F. S. Employment Service

To contact firms seeking personnel through "Help Wanted" items write to American Foundrymen's Society, 222 West Adams St., Chicago 6, designating Item Number and issue of AMERICAN FOUNDRYMAN in which published. A.F.S. Applicant Registration Form then will be sent to applicant for filling in and returning to A.F.S. Headquarters. The form will be sent by Headquarters to the firm whose name will be divulged to the applicant at the same time. All negotiations thereafter must be made between applicant and firm.

Firms desiring to contact applicants should write A.F.S. Headquarters on firm letterhead, designating Item Number and issue. Copy of applicant's Registration Form then will be sent to firms and all negotiations thereafter must be carried on direct with applicant.

POSITIONS WANTED

PW102—Foundryman: Engineering graduate, 24, married, desires opportunity to thoroughly learn foundry business. Experience to date approximately 2¼ years in unrelated field, but broadening. Want to start at bottom. Learn rapidly. Can carry percentage of own weight immediately with small concern by doing anything while learning. Living wage acceptable.

PW103—Foundry Metallurgist: Graduate metallurgist with seven years experience in development work and foundry production problems desires position in foundry production and control. Familiar with cast iron, steel and nonferrous foundry work, heat treating and testing; some sand and core testing.

Letters to the Editor

How Would You Answer This Letter?

Until recently I was a member of the American Foundrymen's Society and I believe in the work you are doing to help the foundry industry. You have assisted me many times through the knowledge contained in your books, papers and AMERICAN FOUNDRYMAN magazine.

However, I am leaving the foundry after 21 years as an apprentice and a molder owing to better conditions, easier work and more money to be made outside of the foundry.

Some foundries may be good places to work, but in _____ the jobbing shops are hopelessly out of date. Even where new equipment has been installed the foremen have retained an 1848 outlook instead of 1948.

The various foundries in this area have not worked out together a system for educating foundry personnel such as you describe in AMERICAN FOUNDRYMAN as going on in other places.

I am sorry to have to drop my membership in A.F.S. but am in a different line of work at present.

I wish the Society every success in the splendid work it is doing.

NAME WITHHELD

How would you answer this man? What has your foundry done to make it the type of place in which this man and many others would like to work? Do you agree or disagree with him?

Send your comments to Editor, *American Foundryman*, 222 West Adams St., Chicago 6, Ill. Best letters will be published, along with pictures of the writers, in "Letters to the Editor" in the near future.

Why Engineers Lose Interest

Informing engineering students of employment opportunities in the foundry industry is part of the writer's work in teaching foundry technology. During vacation periods many Ohio State University students have approached foundries concerning employment after graduation. The technique of students in making their contacts may be faulty, but the stories they relate concerning their experiences indicate that management in some foundries may want to make some improvements in the functioning of their personnel departments.

It is known that the foundries contacted were interested in obtaining graduates. Yet in a number of instances, because of the students' approach or because the receptions accorded the students were poor, they came away with little disposition toward furthering the contacts. These experiences have not dimmed any enthusiasm toward the foundry industry for the students have found satisfactory employment in other foundries in this region.

While every effort is being made to use the services provided by the Foundry Educational Foundation for placing graduates, a number of students are always going to hunt jobs on their own. It is hoped that tales of a few disappointments will not seriously dampen the interest many students now have for employment in the foundry.

DOUGLAS C. WILLIAMS
Assistant Professor
OHIO STATE UNIVERSITY

An enthusiastic and aggressive college foundry instructor, Professor Williams has an excellent record for placing engineering school students in summer foundry jobs and jobs after graduation. Not an FEF school, Ohio State keeps foundry interest high through Professor Williams' activities and through an active student chapter of A. F. S. The article "*Foundry Career Opportunities*," excerpted from the OSU Student Chapter installation address (page 49, this issue), points out the indifference sometimes shown to what college trained men seeking a career or advancement in the foundry industry have to offer.—*Editor*.

A.F.S. Membership Again Proves Valuable

We wish to thank you for your kindness in forwarding the A.F.S. FILM DIRECTORY for use in our foundry training program. This is literally the answer to all our problems for visual aid training as well as other phases of our general training curricula.

We can only repeat that our membership in the American Foundrymen's Society has once again been more than exceedingly worthwhile.

N. F. RITCHEY
ALUMINUM SALES DIVISION
REYNOLDS METALS CO.
Louisville, Ky.

Available at no cost on request from anyone interested in visual aids for foundry training, the *A.F.S. Film Directory* is supplemented by reviews of current film releases in the Foundry Literature department of *American Foundryman*.—*Editor*.

Reach Foundrymen Through Own Magazine

We wish to express appreciation of the publicity you gave the Gray Iron Founders' Society in connection with our recent annual meeting (AMERICAN

FOUNDRYMAN, November 1948, page 67). AMERICAN FOUNDRYMAN reaches many men who probably would not have had this information and it may make a few foundries decide to help themselves by getting into the GIFS cost program. The more foundries we can help on costs, the more it should stabilize the market on castings resulting in more foundries living up to your slogan "The Foundry is a *good* Place to Work."

A. E. HAGEBOECK, *Exec. V. P.*
FRANK FOUNDRIES CORP.
Moline, Ill.

First recipient of the GIFS gold medal, presented at the annual meeting, October 14-15, 1948, Mr. Hageboeck has been chairman of the GIFS Cost committee since 1945. He is a Past National Director of the American Foundrymen's Society.—*Editor.*

Popular Story In Fast-Selling Book

The article *"Colonial Foundries in the New World"* which appeared in the September issue of AMERICAN FOUNDRYMAN has been read by numerous members of our organization and we have all learned things about foundry history that were never known and appreciated before. Will the article be reprinted separately?

H. L. MCCLEES, *President*
CRUCIBLE STEEL CASTING CO.
Lansdowne, Pa.

No plans have been made for reprinting but we will be glad to quote on reprints if you are interested. You would enjoy reading the book, *Development of the Metal Castings Industry*, from which *"Colonial Foundries in the New World"* was taken. This recent A.F.S. publication is reviewed extensively on page 33 of this issue of *American Foundryman*. —*Editor.*

Uses A.F.S. Code On Exhaust Systems

As part of my college degree requirements I am preparing a thesis on *"Air Pollution Control."* My reference material includes your publication FUNDAMENTALS OF DESIGN, CONSTRUCTION, OPERATION AND MAINTENANCE OF EXHAUST SYSTEMS.

RANDOLPH W. OTT
Los Angeles

You are welcome to quote from any of the six A. F. S. safety and hygiene codes. It is only necessary to acknowledge the source, mentioning it as a publication of this society. —*Editor.*

Extra American Foundryman Indexes

INDEX TO VOLUMES 13 AND 14 OF AMERICAN FOUNDRYMAN, cataloging material published in "The Foundrymen's OWN Magazine" during 1948 was distributed with the December, 1948, issue of the magazine.

A limited number of indexes for 1945, 1946, 1947, and 1948 is available at no cost to A.F.S. members and subscribers who need them for reference or binding.

Apprentice Training in the Middle Eastern oil fields is described in a letter from Don E. Richards, former member of the A.F.S. Apprentice Training Committee, pictured here with a group of Arab students in one of two trade schools conducted by the Arabian American Oil Co., at Dhahran, Saudi Arabia. Mr. Richards, who became Education and Training Supervisor for the oil company this spring, reports that these Arabs are able to master semi-difficult technical operations in from one to two weeks under company guidance.

New AFS MEMBERS

Period November 15-December 15: Ending 1948 with 167 new members, the American Foundrymen's Society gained nine more members than during the same period a year ago. New company members continued to increase at the high rate which has marked 1948. Leading chapters during the November 15-December 15 period were: Eastern Canada & Newfoundland, 21; Saginaw Valley, 20; Northeastern Ohio, 11; Northern Illinois-Southern Wisconsin, 10.

NEW COMPANY MEMBERS

Jeffry Mfg. Co., Ltd., Montreal, Que.—Jules Deistler, Sls. Engr. Fdy. Div.—(Eastern Canada & Newfoundland Chapter).

Le Belle Alum. Reg'd, Montreal, Que.—William Gendrow, Gen. Mgr.—(Eastern Canada & Newfoundland Chapter).

The International Nickel Co., Inc., Bayonne, N. J.—L. E. Grubb, Gen. Supt.—(Metropolitan Chapter).

Phillips Fdy. Co., Los Angeles.—Maurice L. Hickman, Slsmn.—(Southern California Chapter).

Superior Electrocast Fdy. Co., San Francisco—Charles Hoehn, Jr., President & Gen. Mgr.—(Northern California Chapter).

Thomas Summerson & Sons, Ltd., Durham, England—H. P. R. Scott—Conversion from Personal.

Tepeyac Insurgentes, Mexico, D. F., Mexico—Charles G. Seifert, Jr.—Conversion from Personal—(Mexico City Chapter).

Sumerbank, Ulus Meydani, Ankara, Turkey.

The Fenton Fdy. Supply Co., Dayton, Ohio—J. L. Thies, Vice President—(Cincinnati Chapter).

American Coke & Coal Chem. Inst., Washington, D. C.—Samuel Weiss, Executive Secretary—Conversion from Personal—(Chesapeake Chapter).

BRITISH COLUMBIA CHAPTER

Karel Alston, Mgr., General Metals Industries Ltd., Vancouver, B. C.
Stuart Diack, Molder, Dickson Foundry, Vancouver, B. C.
Edward A. Dickson, Molder, Dickson Foundry, Vancouver, B. C.
Bandy Douglas, Molder, Dickson Foundry, Vancouver, B. C.
Donald R. Ferguson, Met., Terminal City Iron Works, Vancouver, B. C.
D. A. Mackie, Coremaker, A-1 Iron & Steel Fdy., Vancouver, B. C.
Stanley J. Mason, Terminal City Iron Works, Vancouver, B. C.
George Popeniuk, Molder, Dickson Fdy., Vancouver, B. C.
R. Shaw, Fdy. Supt., Westminster Fdy. Co., Ltd., New Westminster, B. C.

CENTRAL MICHIGAN CHAPTER

Fred Blaine, Melting Supt., Centrifugal Fusing Corp., Lansing, Mich.
Lawrence M. Fagerlund, Student, Michigan State College, E. Lansing, Mich.
John Gedmin, Gen. Fmn., Centrifugal Fusing Corp., Lansing, Mich.
Hugh A. Johnson, Owner, Grant Johnson & Son, Kalamazoo, Mich.
Richard C. Meissner, Student, Michigan State College, E. Lansing, Mich.
Albert D. Pierce, Plt. Engr., Centrifugal Fusing Corp., Lansing, Mich.

CENTRAL NEW YORK CHAPTER

Dana C. Howard, Dist. Repr., Swan Finch Oil Corp., Syracuse, N. Y.
Chester J. Mack, Asst. Supt., Galeton Foundry Co., Inc., Galeton, Pa.
Clyde Weir, Asst. Supt., U. S. Radiator Corp., Geneva, N. Y.

CHICAGO CHAPTER

John W. Cosgrove, Slsmn., Chicago Retort & Firebrick Co., Chicago.
I. H. Dennen, Engr., Beardsley & Piper Co., Chicago.
Russell J. Geitman, Engr., Link-Belt Co., Chicago.
R. C. Howell, Asst. Wks. Mgr., American Steel Foundries, E. Chicago, Ind.
Burke Lanham, Fmn., Wm. E. Pratt Mfg. Co., Joliet, Ill.

CINCINNATI CHAPTER

George M. D'Angelo, Student, University of Cincinnati, Cincinnati.
Ernest A. Knauf, Student, University of Cincinnati, Cincinnati.
Merrick F. McCarthy, Jr., Student, University of Cincinnati, Cincinnati.
John D. Sheley, Met., The Black Clawson Co., Hamilton, Ohio.
Donald J. Smally, Student, University of Cincinnati, Cincinnati, Ohio.
The Fenton Fdy. Supply Co., Dayton, Ohio, (J. L. Thies, Vice-Pres.).

DETROIT CHAPTER

Ralph W. Barker, Met., Wilson Foundry & Machine Co., Pontiac, Mich.
Charles A. Carolin, Pres., R. B. Carolin Fdy. & Machine Co., Detroit.
Edgar R. Clemons, Student, University of Michigan, Ann Arbor, Mich.
C. G. McCollom, Pres., McCollom Metals Inc., Detroit.
Irving E. Oakes, Engr., Dostal Per-Mold Fdy. Co., Pontiac, Mich.

EASTERN CANADA & NEWFOUNDLAND CHAPTER

Donald A. Bentley, Appr. Molder, Dominion Engineering Works, Lachine, Que.
Gerard Bourgeois, Molder, Dominion Engineering Works, Lachine.
Roland Carignan, Appr. Pattern Maker, Robert Mitchell Co., Montreal, Que.
Bert Crotty, Industrial Repr., La Salle Builders Supply Ltd., Montreal, Que.
John De Bellefeuille, Production Clerk, Robert Mitchell Co., Montreal, Que.
Jeffrey Mfg. Co., Ltd., Montreal, Que.—Jules Deistler, Sls. Engr.,
Charles Demers, Core Maker, Montreal Bronze, Montreal, Que.
Leonard Desautels, Supt., Superheater Co., Sherbrooke, Que.
Pierre C. Despres, Proprietor, Fonderie Despres, Montmagny Sta., Que., Canada.
Lucien Emond, Core Maker, Robert Mitchell Co., Laurent, Canada.
Le Belle Aluminum Reg.'d., Montreal, Que.—William Gendrow, Gen. Mgr.
John D. Houston, Salesman, LaSalle Coke Co., Montreal, Que.
Clifford Arthur Hughes, Sls., Alex Bremner Ltd., Montreal, Que.
W. F. Johnston, Mechanical & Electrical Supt., Canadian Car & Foundry Co., Ltd., Montreal, Que.
Jerzy Kaluzny, Met. Engr., Dominion Engineering Works Ltd., Montreal, Que.
Jean Labbe, Mgr., La Fonderie Paquette Engr., Lapraitie, Que.
Alfred McKenven, Cupola Man, Fdy. Div., Robert Mitchell Co., Ville St. Laurent, Que.
S. G. Mitchell, Robert Mitchell Co., Ltd., Ville St. Laurent, Que.
George Nadeau, Slsmn., La Salle Builders Supply Ltd., Montreal, Que.
Thomas Rice, Molder, Superheater Co., Sherbrooke, Que.
Edouard Roy, Pattern Shop Fmn., The Superheater Co., Ltd., Sherbrooke, Que.

EASTERN NEW YORK CHAPTER

George E. Danner, Met., American Locomotive Co., Schnectady, N. Y.
Leopold Naguszewski, Sand Tech., American Locomotive Co., Schenectady, N. Y.
Willys O. Zilles, Molder, General Electric Co., Schenectady, N. Y.

METROPOLITAN CHAPTER

The International Nickel Co., Inc., Bayonne, N. J.—L. E. Grubb, Gen. Supt.
Stanley E. Handman, Instructor in Industrial Practice, Polytechnic Institute of Brooklyn, Bronx, N. Y.

MEXICO CITY CHAPTER

Lino Cortez Estevez, Foundryman & Industrial Engineering, Fundicion Artistica Mecanica Industrial, Monterrey Nuevo Leon, Mex.

MICHIANA CHAPTER

Richard T. Clark, Asst. Chf. Met., Salisbury Axle Works, Fort Wayne, Ind.
Thornton Nuzum, Pattern Engineer, Salisbury Axe Works, Ft. Wayne, Ind.

NORTHEASTERN OHIO CHAPTER

Robert L. Collins, Fmn., Aluminum Co. of America, Cleveland.
R. J. Gollmar, Prod. Mgr., Elyria Fdy., Industrial Brownhoist Corp., Elyria, Ohio.
John James Hayes, Night Supt., The Lake City Malleable Co., Cleveland.
Jules Henry, Student, Case Institute of Tech., Cleveland.
George A. Leschock, Prod. Mgr., Forest City Foundries Co., Cleveland.
Ralph F. Merriam, Purchasing Agent, Grand Industries, Inc., Cleveland.
Frank Joseph Oklessen, Pattern Maker, Motor Patterns Co., Cleveland.
Joe Principe, Labor Fmn., The Lake City Malleable Co., Cleveland.
Robert E. Schroeder, Trader, Luria Brothers & Co., Inc., Cleveland.
William J. Sikula, Pattern Shop Fmn., Wellman Bronze & Aluminum Co., Cleveland.
John Wallis, Gen. Fmn., Aluminum Co. of America, Cleveland.

NORTHERN CALIFORNIA CHAPTER

Superior Electrocast Fdy. Co., San Francisco—Charles Hoehn, Jr., Pres. & General Manager.
Frank H. Thames, Jr., Wilson & Geo. Meyer & Co., San Francisco.
Frank Zuest, Treasurer, Superior Electrocast Fdy. Co., San Francisco.

NO. ILLINOIS & SO. WISCONSIN CHAPTER

Vincent Badalucco, Fmn., Gunite Foundries Corp., Rockford, Ill.
Steven Cintella, Fmn., Gunite Foundries Corp., Rockford, Ill.
Charles N. Deubner, Fdy. Supt., Yates American Machine Co., Beloit, Wis.
William A. Eschenburg, Chief Engineer, Rockwell Mfg. Co., Freeport, Ill.
Palmer E. Hanson, Mgr. Fdy. Equipment Div.,
Arcade Mfg. Div., Rockwell Mfg. Co., Freeport, Ill.
Elmer Krueger, Asst. Fmn., Arcade Mfg. Div.,
Rockwell Mfg. Co., Freeport, Ill.
Joseph Santo Lombardo, Fmn., Gunite Foundries Corp., Rockford, Ill.
Harley C. May, Charging Crane Operator, Beloit Fdy. Co., Beloit, Ill.
John Osberg, Supt., Arcade Mfg. Div., Rockwell Mfg. Co., Freeport, Ill.
Herbert A. Turner, Fdy. Fmn., Beloit Fdy. Co., Beloit, Wis.

NORTHWESTERN PENNSYLVANIA CHAPTER

Bernie M. Fromknecht, Div. Supt., Griswold Mfg. Co., Erie, Pa.
Andrew Mozdy, C/R Fmn., Bucyrus-Erie Co., Erie, Pa.
Joseph Fred Orloff, Fdy. App., Weil-McLain Co., Erie, Pa.
Harry Taylor, Fdy. Fmn., Griswold Mfg. Co., Erie, Pa.
Ernest C. Ullom, Slsmn., Harbison-Walker Refractories, Buffalo, N. Y.

ONTARIO CHAPTER

Neil A. Forsyth, Heading & Gating Asst.,
Dominion Fdries. & Steel Co., Ltd., Hamilton, Ont.

PHILADELPHIA CHAPTER

Herbert C. Gibbs, Salesman,
Pennsylvania Fdy. Supply & Sand Co., Springfield, Mass.
James J. Kennedy, Burns & Wohlgemuth, Philadelphia.
Earl J. Shields, Fmn. Olney Fdy., Link Belt Co., Philadelphia.
W. J. Taylor, Mgr. of Service, General Steel Casting Corp., Glenolden, Pa.

QUAD CITY CHAPTER

Fred H. Brewer, Fdy. Appr., Farmall Wks.,
International Harvester Co., Moline, Ill.
James Kalyvas, Corn Products Sales Co., Davenport, Iowa.

SAGINAW VALLEY CHAPTER

C. Russell Baker, Student, Central Fdy. Div., G. M. Institute, Flint, Mich.
Harold F. Carr, Jr., Fmn., Saginaw Malleable Iron Plant, Saginaw, Mich.
Bernard M. Federspiel, Fdy. Fmn., Chev. Grey Iron Fdy.,
General Motors Corp., Saginaw, Mich.
Joseph R. Fillion, Gen. Fmn., Chev. Grey Iron Fdy.,
General Motors Corp., Saginaw, Mich.
Jerome E. Gallant, Gen. Fmn., Chev. Grey Iron Fdy.,
General Motors Corp., Saginaw, Mich.
Andrew Glavanovich, Fmn. Core Dept., Chev. Grey Iron Fdy. Div.,
General Motors Corp., Saginaw, Mich.
Ernest E. Harkess, Fmn. Pattern Shop, Buick Motor Div.,
General Motors Corp., Flint, Mich.
Raymond C. Hawkins, Co-op Student,
General Motors Institute, Saginaw, Mich.
Edward Higham, Inspector, General Foundry & Mfg. Co., Flint, Mich.
John A. McFarlane, Met., Brisk Foundry & Machine Co., Imlay City, Mich.
Harry M. Marshall, Pattern Maker, General Foundry Mfg. Co., Flint, Mich.
Wallace C. Olson, Met., General Fdy. & Mfr. Co., Flint, Mich.
Robert Pittsley, Met., Dow Chemical Co., Bay City, Mich.
Harry C. Raymond, Sand Cont., Chev. Grey Iron Fdy.,
General Motors Corp., Saginaw, Mich.
Ormond Reuttadt, Pattern Engineer, Dow Fdy. Div.,
Dow Chemical Co., Bay City, Mich.
Donald W. Rozell, Student, General Motors Institute, Flint, Mich.
Fred W. Serr, Prod. Checker, General Fdy. & Mfg. Co., Flint, Mich.
Frank A. Simons, Asst. to Tech. Dir.,
The Dow Chemical Co., Bay City, Mich.
Steve Spess, Student, Central Fdy. Div.,
General Motors Institute, Flint, Mich.
Otto Wruck, Fdy. Fmn., Chev. Grey Iron Fdy.,
General Motors Corp., Saginaw, Mich.

ST. LOUIS DISTRICT CHAPTER

Eugene Conreaux, Sls. & Service, Illinois Cereal Mills Inc., Granite City, Ill.

SOUTHERN CALIFORNIA CHAPTER

Guy N. Ackerman, Asst. Plt. Supt., Phillips Fdy. Co., Bakersfield, Calif.
Manley E. Brooks, Fdy. Engr.,
Magnesium Alloy Products Co., Compton, Calif.
Carl F. Fox, Plt. Supt., Phillips Fdy. Co., Bakersfield, Calif.
William J. Gates, President, Phillips Fdy. Co., Bakersfield, Calif.
Phillips Fdy. Co., Los Angeles—Maurice L. Hickman, Slsmn.
Charles N. Phillips, Secy.-Treas., Phillips Fdy. Co., Bakersfield, Calif.
Alphonse Schmitz, Chief Melter, Phillips Fdy. Co., Bakersfield, Calif.
Ray O. Smith, Pattern Maker, Firestone Pattern, South Gate, Calif.

TENNESSEE CHAPTER

James Minter, Dist. Sls. Mgr.,
A. P. Green Fire Brick Co., Chattanooga, Tenn.

TEXAS CHAPTER

Raymond C. Anthony, Cleaning Dept. Supt. & Insp., Fdy. Div.,
Jaques Power Saw Co., Mineral Wells, Texas.
Frank W. McBee, Jr., Instructor in Mech. Engineering,
University of Texas, Austin, Texas.
Byron B. McCroskey, Plt. Mgr., Fdy. Div.,
Jaques Power Saw Co., Mineral Wells, Texas.
Harry J. Opanowitz, Supt., Jaques Power Saw Co., Mineral Wells, Texas.

TWIN CITY CHAPTER

Horace S. Graham, Gen. Supt., King Fdy. Inc., Minneapolis.
Paul Sorensen, C/R Fmn., King Foundry Inc., Minneapolis.

WESTERN MICHIGAN CHAPTER

L. J. Haga, President, State Heat Treat, Inc., Grand Rapids, Mich.
Clifford J. Miller, Industrial Engr.,
Campbell, Wyant & Cannon Fdy. Co., Muskegon, Mich.
Robert S. Whitlow, Fmn.,
Campbell, Wyant & Cannon Fdy. Co., Muskegon, Mich.

WESTERN NEW YORK CHAPTER

Herbert J. Cutler, Jr., Asst. Fmn.,
American Radiator & Standard Sanitary Corp., Buffalo, N. Y.
Prof. C. V. Guenther, Head, Met. Dept.,
New York State Institute of Applied Arts & Sciences, Buffalo, N. Y.
John B. May, American Radiator & Stand. Sanitary Corp., Buffalo, N. Y.
Andre L. Mechelynck,
American Radiator & Standard Sanitary Corp., New York.

WISCONSIN CHAPTER

Robert C. Brand, Abrasive Engr., United States Rubber Co., Milwaukee.
Roger J. Brukardt, Chief of Timekeeping & Payroll,
International Harvester Co., Waukesha, Wis.
Frank Marman, Fmn., Mid-City Foundry Co., Milwaukee.
George P. Pusey, Fdy. Student, International Harvester Co., Milwaukee.
Edwin I. Tarr, General Fmn., International Harvester Co., Milwaukee.

STUDENT CHAPTERS

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Norman N. Olsen
Richard A. Poirier

MISSOURI SCHOOL OF MINES & METALLURGY

Joseph S. McVey, Jr.
August R. Savu
Larson E. Wile

OREGON STATE COLLEGE

Bernhard Deckman
Harlin H. Hall
Eli H. Keeran
Justin Thomas Morgan
Carl B. Nabb
William L. Stoneback
Arthur Rudolf Thompson

OUTSIDE OF CHAPTER

Everett M. Johnson, Night Supt., Grinnell Corp., Greenwood, R. I.
Edward E. Reid, Gen. Supt., Bridgeport Brass Co., Exeter, N. H.
William J. White, Gen. Mgr., Penn Scott Foundries, Inc., Scottdale, Pa.
Charles C. Zircher, Fdy. Equip. Sls.,
Black, Sivalls & Bryson, Inc., Kansas City, Mo.

Argentina
Jose Maria Azarola, Ingeniero Metalurgico, Buenos Aires, Argentina.

Brazil
Ernesto Colombelli, Steel Tech., Sao Paulo, Brazil.

India
Sudhir Chandra Chakrabarti, Senior Met., Tata Iron & Steel Co., Ltd.

Turkey
Sumerbank, Ulus Meydani, Ankara, Turkey.

Wisconsin Chapter Issues Directory

FOREMOST PURPOSE of the Wisconsin Chapter is the presentation of technical and educational programs, according to Chapter President R. C. Woodward's (Bucyrus-Erie Co.) message in the 1948-49 chapter directory and program just issued. In addition to listing all members of the Wisconsin Chapter, the directory gives a short history of the chapter and of A. F. S., chapter by-laws, and lists the officers, directors, and committee members of the chapter.

FOUNDRY Personalities

Floyd D. Holben, foreman of the C. S. Humphrey Co., Moline, Ill., for three years, recently left to accept the position of superintendent of the Sterling Casting Corp., Bluffton, Ind.

Howard B. Myers, formerly research metallurgist for the Mellon Institute, Pittsburgh, as of November 1 accepted the newly-created position of technical director of the Roll Manufacturers Institute, Pittsburgh, where he will be responsible for directing a program of research into the manufacture and use of cast iron and cast steel rolls for rolling mills. Mr. Myers attended both Johns Hopkins University and the University of Pittsburgh, and was

H. B. Myers

a member of the production staff of Rustless Iron & Steel Corp., Baltimore, and metallurgist with McConway & Torley Corp., Pittsburgh, prior to joining the Mellon Institute.

Lewis Emanual Young, Pittsburgh consulting mining engineer, was elected president of the American Institute of Mining and Metallurgical Engineers for 1949, at a meeting of Institute directors on November 17. **Augustus Braun Kinzel,** president of Union Carbide and Carbon Research Laboratories, New York, and **Philip Kraft,** vice-president, Newmont Mining Corp., New York, were elected vice-presidents. Among new directors elected at the meeting are **William J. Coulter,** general manager, Climax Molybdenum Co., **W. M. Pierce,** New Jersey Zinc Co., **Frederick N. Rhines,** associate professor of Metallurgy, Carnegie Institute of Technology and **C. D. King,** United States Steel Corp.

Clyde A. Sanders was recently elected a vice-president of the American Colloid Co., Chicago. Mr. Sanders, one of the foundry industry's best-known authorities on sand practices, has been guest speaker at many A.F.S. technical meetings and has authored many articles on the subject for AMERICAN FOUNDRYMAN. His *Foundry Sand Practice* has had wide distribution throughout the foundry industry. Mr. Sanders studied Ceramic Engineering at Ohio State University and was active there in the development of Ohio clays. Prior to joining American Colloid in 1942, Mr. Sanders was with the Lawrence Clay Co.

Herbert J. Bauman, chairman of the A.F.S. Northern Illinois-Southern Wisconsin chapter, recently joined the Foundry Division of the Beloit Iron Works, Beloit, Wis. Mr. Bauman was formerly Core-Oil Division representative for Smith Oil &

H. J. Bauman

Refining Co. After graduation from vocational training school in Waukesha, Wis., Mr. Bauman's first position was in the pattern department of General Malleable Corp. in that city. He later joined Ebaloy Foundries, Inc., Rockford, Ill., in 1938, and was factory manager there during the war.

Carl A. Shem was recently appointed director of advertising of the Werner G. Smith Division of the Archer-Daniels-Midland Co., Cleveland, succeeding **Waldemar Meckes,** who has been appointed an assistant to the executive vice-president. Mr. Shem left Cornell University to join the Army during World War II and saw service in the Pacific. For the last two years he has been a Werner G. Smith sales representative in the Milwaukee area.

Frederick G. Heuchling, Jr., one of the first Foundry Educational Foundation Fellowship students to graduate from the Massachusetts Institute of Technology, was recently appointed sales engineer for the Whiting Corp., Harvey, Ill. Mr. Heuchling, who was also a recipient of an M.I.T. Alumni Regional Scholarship in 1941, was awarded the Silver Star for gallantry in action while serving with an Armored Infantry unit during World War II. During his school years, Mr. Heuchling was employed by several Illinois and Massachusetts foundries.

J. Wesley Cable, formerly director of Research and Sales of the Induction Heating Corp., has opened offices as a consultant to the high frequency heating field and will specialize in both induction and dielectric heating. His offices are located at 325 E. 41st St., New York, 17.

N. George Belury was recently appointed president of the Engineered Castings Division of the American Brake Shoe Co.

N. G. Belury

Mr. Belury has been with Brake Shoe since graduating from Purdue University in 1937. Formerly Division vice-president, he has also served as sales manager.

C. L. Beatty has been elected executive vice-president of the Campbell, Wyatt & Cannon Foundry Co., Muskegon, Mich., at a recent meeting of the company's board of directors. Other executives elected are **W. R. Krepps,** vice-president in charge of production; **D. J. Vail,** vice-president in charge of manufacturing; and **I. K. MacGregor,** vice-president in charge of sales. Mr. Beatty has been associated with the company since 1915 and has been general manager of the National Motor Castings Division, South Haven, Mich., for the last 25 years. Mr. Krepps, a director of the A.F.S. Western Michigan chapter, was formerly assistant manufacturing manager of Muskegon plants. Mr. Vail, an employee since 1930, is president of the Motor Castings Association, and was formerly general manufacturing manager of Muskegon plants. Mr. MacGregor, a native of Scotland, joined CWC in 1944 after serving as a British Ministry of Supply emissary to the United States for the purpose of pur-

chasing war materiel for Britain. He was appointed CWC sales manager in 1946.

David B. Herbison, formerly of Montreal, Que., Canada, has accepted a position as metallurgist with the Massey-Harris Co., Ltd., Brantford, Ont.

Ralph N. Schaper was recently appointed superintendent of the Wisconsin Appleton Co., South Milwaukee, Wis., succeeding **William F. Hoernke,** who retired after 58 years' service to the foundry industry. Mr.

R. N. Schaper

Schaper, an M.S. from the University of Wisconsin (1937) in Metallurgy, held supervisory positions with the Fort Pitt Steel

W. F. Hoernke

Casting Co., McKeesport, Pa., Westlectric Castings Co., Los Angeles, and the Marion Malleable Iron Works, Marion, Ind., prior to joining Wisconsin Appleton. Mr. Hoernke began his foundry career at the age of 14 as an apprentice molder at the old Northwestern Malleable Iron Co., Milwaukee, in 1896. He has been 53 years with Northwestern and its successor company, Wisconsin Appleton, and superintendent for 36 years. In 1943, Mr. Hoernke was the recipient of an honorary award from the A.F.S. Wisconsin chapter for 50 years of foundry service.

James E. Mitchell, formerly with the Bettendorf, Iowa, Works of the J. I. Case Co., has been appointed industrial relations director of the Ainsworth Mfg. Corp.

A. F. S. CHAPTER DIRECTORY

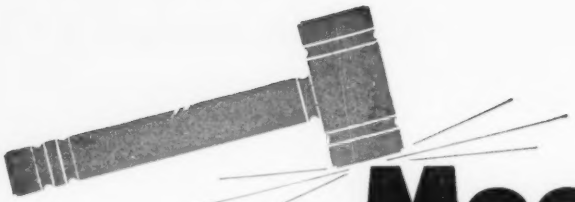
BIRMINGHAM DISTRICT CHAPTER
Secretary-Treasurer, F. K. Brown, Adams, Rowe & Norman, Inc.
BRITISH COLUMBIA CHAPTER
Secretary-Treasurer, L. P. Young, A-1 Steel & Iron Foundry Ltd.
CANTON DISTRICT CHAPTER
Secretary, Robt. L. Fasig, Ashland Malleable Iron Co.
CENTRAL ILLINOIS CHAPTER
Secretary-Treasurer, Vern M. Swango, Caterpilla Tractor Co.
CENTRAL INDIANA CHAPTER
Secretary, Jack Giddens, International Harvester Co.
CENTRAL MICHIGAN CHAPTER
Secretary-Treasurer, George Petredean, Calhoun Foundry Co.
CENTRAL NEW YORK CHAPTER
Secretary, David Dudgeon, Jr., Utica Radiator Co.
CENTRAL OHIO CHAPTER
Secretary, D. E. Krause, Gray Iron Research Institute.
CHESAPEAKE CHAPTER
Secretary-Treasurer, C. A. Robeck, Gibson & Kirk Co.
CHICAGO CHAPTER
Secretary, V. M. Rowell, Velsicol Corp.
CINCINNATI DISTRICT CHAPTER
Secretary, B. A. Genthe, S. Obermayer Co.
DETROIT CHAPTER
Secretary, J. N. Phelps, Vanadium Corp. of America.
EASTERN CANADA AND NEWFOUNDLAND CHAPTER
Secretary, J. G. Hunt, Dominion Engineering Works Ltd.
EASTERN NEW YORK CHAPTER
Secretary-Treasurer, Ugo Navarette, General Electric Co.
METROPOLITAN CHAPTER
Secretary, J. F. Bauer, Hickman, Williams & Co.
MEXICO CITY CHAPTER
Secretary, N. S. Covacevich, La Consolidada S.A.
MICHIANA CHAPTER
Secretary-Treasurer, V. S. Spears, American Wheelabrator & Equip. Co.
NORTHEASTERN OHIO CHAPTER
Secretary, R. D. Walter, Werner G. Smith Co.
NORTHERN CALIFORNIA CHAPTER
Secretary, Charles R. Marshall, Chamberlain Co.
NORTHERN ILLINOIS-SOUTHERN WISCONSIN
Secretary, F. W. Thayer, Gunite Foundries Corp.
NORTHWESTERN PENNSYLVANIA CHAPTER
Secretary, Reginald Harding, Pickands-Mather Co.
ONTARIO CHAPTER
Secretary-Treasurer, G. L. White, Westman Publications Ltd.
OREGON CHAPTER
Secretary-Treasurer, Geo. C. Vann, Northwest Fdry. & Fce. Co.
PHILADELPHIA CHAPTER
Secretary-Treasurer, W. B. Coleman, W. B. Coleman & Co.
QUAD CITY CHAPTER
Secretary-Treasurer, C. R. Marthens, Marthens Co.
ROCHESTER CHAPTER
Secretary-Treasurer, L. C. Kimpal, Rochester Gas & Electric Corp.
SAGINAW VALLEY CHAPTER
Secretary-Treasurer, Raymond H. Klawuhn, General Fdry. & Mfg. Co.
ST. LOUIS DISTRICT CHAPTER
Secretary, P. E. Retzlaff, Busch-Sulzer Bros.-Diesel Engrg. Co.
SOUTHERN CALIFORNIA CHAPTER
Secretary, J. E. Wilson, Climax Molybdenum Co.
TENNESSEE CHAPTER
Secretary-Treasurer, Herman Bohr, Jr., Robbins & Bohr.
TEXAS CHAPTER
Secretary-Treasurer, P. B. Croom, Houston Pattern Works
TIMBERLINE CHAPTER
Secretary, John W. Horner, Jr., Slack-Horner Brass Mfg. Co.
TOLEDO CHAPTER
Secretary-Treasurer, R. H. Van Hellen, Unitcast Corp.
TRI-STATE CHAPTER
Secretary, D. A. Mitchell, Progressive Brass Mfg. Co.
TWIN CITY CHAPTER
Secretary-Treasurer, L. K. Polzin, Minneapolis Chamber of Commerce
WASHINGTON CHAPTER
Secretary-Treasurer, Fred R. Young, E. A. Wilcox Co.
WESTERN MICHIGAN CHAPTER
Secretary, S. H. Davis, Campbell, Wyant & Cannon Fdry.
WESTERN NEW YORK CHAPTER
Secretary, R. E. Walsh, Hickman, Williams & Co.
WISCONSIN CHAPTER
Secretary, W. W. Edens, Badger Brass & Aluminum Fdry. Co.

39

STUDENT CHAPTERS

UNIVERSITY OF MINNESOTA *Secretary,* Harvey Sauby
MISSOURI SCHOOL OF MINES *Secretary,* Martin L. Slawsky
OHIO STATE UNIVERSITY *Secretary-Treasurer,* Eldon Boner
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Secretary-Treasurer, Martin J. O'Brien
OREGON STATE COLLEGE *Secretary,* John P. Meece
UNIVERSITY OF ILLINOIS *Secretary,* Robert W. Bales
TEXAS A & M COLLEGE *Secretary,* Victor C. Henkel.

7



Chapter Meetings

JANUARY 17

QUAD CITY
Ft. Armstrong Hotel, Rock Island, Ill.
R. G. McElwee
Vanadium Corporation of America
"A. F. S. Cupola Research"

JANUARY 18

CENTRAL MICHIGAN
Columbia Hotel, Kalamazoo
William Ball, Jr.
R. Lavin & Sons, Inc.
"Non-Ferrous Foundry Practices"

JANUARY 20

DETROIT
Rackham Educational Memorial
Group Meetings

JANUARY 21

WESTERN NEW YORK
Troop I Legion Post, Buffalo
Annual Stag Party

TENNESSEE
Hotel Patten, Chattanooga
J. A. Bowers
American Cast Iron Pipe Co.
"Foundry Coke"

JANUARY 24

NORTHWESTERN PENNSYLVANIA
Moose Club, Erie
N. Ransohoff
N. Ransohoff, Inc.
"Wet Cleaning of Castings"

JANUARY 24

TIMBERLINE
Oxford Hotel, Denver
W. R. Jaeschke
Whiting Corp.
Subject to be announced

JANUARY 28

CHESAPEAKE
Engineers' Club, Baltimore
Gray Iron, Steel and Non-Ferrous
Round Table Meetings

JANUARY 28

ONTARIO
Royal Connaught Hotel, Hamilton
Past Chairman's Night
N. J. Dunbeck
Eastern Clay Products Co.
"Chemically Coated Sands"

FEBRUARY 1

MICHIANA
LaSalle Hotel, South Bend, Ind.
H. L. Campbell
Argo Corn Products Co.
"Cores and Materials"

FEBRUARY 2

TOLEDO
Toledo Yacht Club
H. J. Jacobson
Industrial Pattern Co.
"Venting and Rigging Core Boxes for Core Blowing"

FEBRUARY 3

TWIN CITY
Covered Wagon, Minneapolis
W. B. McFerrin
Electro Metallurgical Co.
"Casting Defects"

SAGINAW VALLEY
Fisher's Hotel, Frankenmuth, Mich.
Edgar R. Maier
Saginaw Pattern & Mfg. Co.
"Modern Pattern Equipment"

FEBRUARY 7

CENTRAL INDIANA
Athenaeum, Indianapolis
National Officers' Night
William Romanoff
H. Kramer & Co.
"Non-Ferrous Melting Practice"
J. A. Bowers
American Cast Iron Pipe Co.
"Foundry Coke"

CHICAGO
Chicago Bar Association
Round Table Meetings

CENTRAL ILLINOIS
Jefferson Hotel, Peoria
Carl F. Joseph
Central Foundry Division, G.M.C.
"Control of Materials and Operations in a Malleable Foundry"

METROPOLITAN
Essex House, Newark, N. J.
Lyle L. Clark
Buick Motor Co.
"Cupola Operation"

FEBRUARY 8

ROCHESTER
Seneca Hotel, Rochester
R. J. Forkey
Norton Co.
"Grinding Wheel Safety"

N. ILLINOIS-S. WISCONSIN
Faust Hotel, Rockford, Ill.
George K. Dreher
Foundry Educational Foundation
"Foundry Education"

FEBRUARY 11

PHILADELPHIA
Engineers' Club, Philadelphia
F. J. Liederbach
Olney Foundry Div., Link Belt Co.
"What the Foundry Requires in a Pattern"

EASTERN CANADA & NEWFOUNDLAND
Mount Royal Hotel, Montreal
Quiz Night

CENTRAL NEW YORK
Onondaga Hotel, Syracuse
Ralph Denton
A. P. Green Firebrick Co.
"Modern Ferrous and Non-Ferrous Refractories"

NORTHERN CALIFORNIA
Planck's Broadway, Oakland
L. D. Pridmore
International Molding Machine Co.
"Automatic Molding"

FEBRUARY 14

CENTRAL OHIO
Chittenden Hotel, Columbus
Malleable Iron and
Steel Group Meetings

CINCINNATI DISTRICT
Engineering Society, Cincinnati
B. D. Claffey
Acme Aluminum Alloys, Inc.
"Foundry Education"

FEBRUARY 18

WASHINGTON
Gowman Hotel, Seattle
George K. Dreher
Foundry Educational Foundation
"Foundry Education"

Chapter Officers AFS and Directors

J. S. Vanick
International Nickel Co.
New York, N.Y.
Director
Metropolitan Chapter

C. O. Penney
C. S. Card Iron Works Co.
Denver, Colo.
Director
Timberline Chapter

E. E. Thompson
Unitcast Corp.
Toledo, Ohio
Chairman
Toledo Chapter

M. J. O'Brien, Jr.
Symington Gould Corp.
Depew, N.Y.
Chairman
Western New York Chapter

Maurice F. Degley
Ferro Machine and Foundry Co.
Cleveland, Ohio
Director
Northeastern Ohio Chapter

M. W. Pohlman
Pohlman Foundry Co., Inc.
Buffalo, N.Y.
Treasurer
Western New York Chapter

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John Deere Planter Works
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C. B. Jenni
General Steel Castings Corp.
Philadelphia, Pa.
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Philadelphia Chapter

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Meadville Malleable Iron Co.
Meadville, Pa.
Chairman
N. W. Pennsylvania Chapter

Dr. J. T. Mackenzie
American Cast Iron Pipe Co.
Birmingham, Ala.
Chairman
Birmingham District Chapter

CHAPTER ACTIVITIES NEWS

British Columbia

Norman Terry
Canadian Sumner Iron Works, Ltd.
Publicity Chairman

NATIONAL OFFICERS' NIGHT, held at the Pacific Athletic Club, Vancouver, December 14, featured an address by A.F.S. National President W. B. Wallis. More than 60 members and friends of the chapter attended.

Preceding Mr. Wallis' talk, members enjoyed a coffee talk by Ronald Klinck of the British Columbia Research Council, who outlined the work being done at the University of British Columbia, particularly in the field of metals research. Mr. Klinck told of research into the metallurgical coke mined and manufactured in British Columbia.

Mr. Wallis, in speaking on A.F.S. activities, congratulated the comparatively new British Columbia chapter on the progress it has made since it was organized a little over a year ago, and strongly urged members to continue their cooperative endeavors.

Outlining the activities of the American Foundrymen's Society in research technical work, publications, and other projects being carried on at present and contemplated for the future, Mr. Wallis convinced his audience that membership in A.F.S. is an invaluable tool to assist the foundryman to improve his work, and in wider development of the metal castings industry.

The following night, members of the chapter Executive Committee met with Mr. Wallis to discuss details of proposed changes in internal workings of the Society, particularly those pertaining to the new dues structure.

It is announced by chapter officials that the chapter will again sponsor a local Apprentice Contest in conjunction with the A.F.S. National Apprentice Contest. The local contest will take place in February and will be divided into four sections: gray iron molding, steel molding, non-ferrous molding and patternmaking.

Tri-State

F. E. Fogg
Acme Foundry & Machine Co.
Chapter Reporter

"CUPOLA OPERATION AND CONTROL" was the subject of an address by L. L. Clark, metallurgist, Buick Motor Corp., at a dinner meeting held November 19 at Wilder's Dining Room, Joplin, Mo. Sixty-six members and guests attended.

"Stay out of trouble in the first place", Mr. Clark told his audience, "rather than wait for trouble to develop". The speaker cited specific examples of do's and dont's of cupola control, and urged all foundries to consider an adequate dust and smoke control program. Mr. Clark discussed various types of charging equipment and reviewed the advantages of the various types of charging materials. The speaker concluded his discussion with slides illustrating all phases of cupola operation at Buick.

Central Ohio

H. W. Lownie, Jr.
Battelle Memorial Institute
Chapter Reporter

APPROXIMATELY 90 MEMBERS and guests met at the Chittenden Hotel in Columbus on November 8 to hear discussions on the cracking of ferrous castings and the quality welding of steel castings.

B. C. Yearly, assistant general manager, National Malleable and Steel Castings Co., Cicero, Ill., addressed the Malleable Iron Section of the Chapter on the subject of *"Cracks in Ferrous Castings"*. Mr. Yearly divided cracks in ferrous castings into the two logical divisions of (1) hot cracks and (2) cold cracks. Both types of cracks are believed to be caused by the same mechanism—restriction of the casting while cooling so that it cannot contract according to its normal thermal contraction characteristics.

Mr. Yearly stated that when a solidifying casting is restricted or held so that it cannot contract, it must either stretch or must crack. When the restricted section is uniform in size and contains no temperature gradients, the stretching can be expected to occur uniformly along the section. When the section contains heavy section, re-entrant angles, or gates, a hot spot will usually be developed and the stretch-

Honored at Saginaw Valley chapter's "Saginaw Malleable Night" were the company staff members who occupied this huge table at dinner.

Chapter President Robert Woodward, Bucyrus-Erie Corp., photographed at a Wisconsin meeting.

ing or cracking will be confined to this area. Emphasis was placed upon the role of cores in restricting the shrinkage of solidifying white iron castings. In the experience of Mr. Yearly, core binders were not so important as the degree of ramming when a highly collapsible core was desired. Light ramming of a core so that the grains were not tightly packed together often resulted in a core which eliminated hot cracking of white iron castings. Such lightly rammed cores had the disadvantages of being very soft and requiring care in handling.

In discussing cold cracks which occur at about room temperature, Mr. Yearly proposed that these cracks occur because of certain conditions which existed in the casting above 1200°F. Although the cracking may not occur until several hours after the casting has reached room temperature, the stress pattern which causes the cracking is believed to be developed at a relatively high temperature. This contention was supported by numerous examples in which the stress patterns in solidifying castings were traced. Mr. Yearly also described the use of holding furnaces to permit castings to establish dimensional stability after being shaken out at a relatively high temperature.

John Wozny, metallurgist, American Steel Foundries Co., Research Department, Indiana Harbor, Ind., addressed the Steel Section of the Chapter on the subject of *"Quality Welding of Carbon-Steel Castings"*. He described the development of coated welding rods which would produce welds with the same strength as Grade B steel castings and still be satisfactory from the welding standpoint. The test procedures and specimens used in the investigation were described at length. It was shown that the thickness of the welded section and the location of the test specimen in the weld had appreciable influence upon the test results. Mineral-coated rods proved to be the most satisfactory in the speaker's experience for the repair of steel castings. Slides of radiographs were used to illustrate many of the points discussed.

The heat treatment used after various types of welding repair was discussed. Usually the repaired castings were given either a tempering or normalizing treatment. It was then found unnecessary to preheat the castings before welding.

Chesapeake

Jack H. Schaum
Naval Research Laboratory
Chapter Reporter

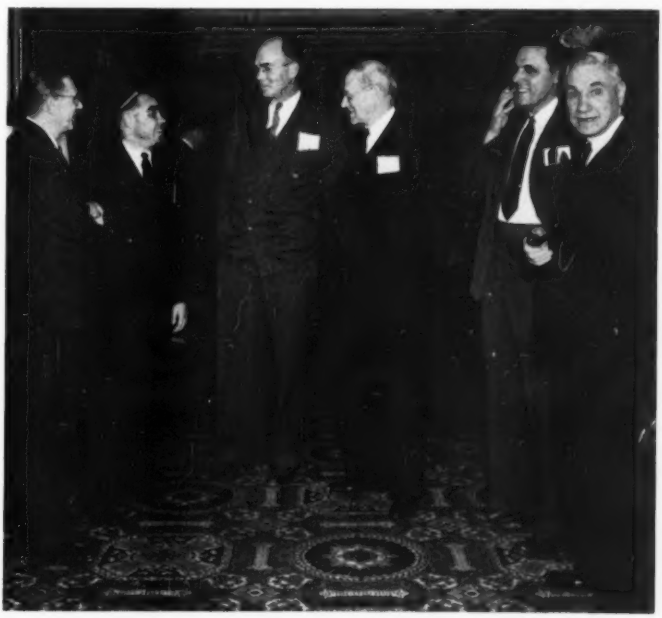
"DEVELOPMENT OF THE MODERN FOUNDRY" an address by E. E. Ballard of Lester B. Knight & Associates, Chicago, was a feature of the November 26 meeting, held at the Engineers' Club, Baltimore.

Mr. Ballard advised operators to balance molding, melting, pouring, shakeout and cleaning capacities of their foundries for maximum economy. The health and comfort of employees is essential, Mr. Ballard added, and the plant should be made safe by proper arrangement of equipment, good housekeeping, and correct safety instruction.

Preventative maintenance should be practiced to avoid complete breakdown of any piece of equipment, Mr. Ballard said, and illustrated his points with pictures of modernized foundries.

During the discussion that followed his talk, Mr. Ballard pointed out that mechanized foundries are not too well adapted to intermittent operation. William Danko of

Snapped at Eastern Canada & Newfoundland chapter's "Past President's Night" are, left to right: Immediate Past Chairman, A. E. Cartwright, Crane Co., Ltd.; Mr. Grogan; Morris McQuiggan, Canadian Foundry Supply & Equipment Co., Ltd., Harold J. Roast, foundry consultant; A. H. Lewis and H. W. Bennett of Dominion Engineering Works, Ltd.



C. A. McNamara (left) vice chairman of the Tri-State chapter, and Dale Hall, chapter chairman (right) swapping foundry talk with L. L. Clark, Buick Motor Co., at the Tri-State Chapter's November meeting.

the National Bearing Co., Portsmouth, Va. supplemented the discussion with a brief description of the mechanization of his company's Portsmouth foundry, where 40,000 journal bearings are made monthly.

Philadelphia

A. Saute
American Engineering Co.
Chapter Reporter

CUPOLA VS. ELECTRIC FURNACE for melting cast iron was the topic of an address given by A. W. Gregg, Whiting Corp., Harvey, Ill., before the November 12 meeting of the chapter at the Engineers' Club, Philadelphia.

Mr. Gregg compared (a) cupola melting (b) batch melting electric furnace practice and (c) duplexing practice with cupola and small electric furnace for superheating.

The three factors considered for each practice were investment, operating cost and operating conditions, according to Mr. Gregg.

The coke situation and the present poor quality of foundry coke used in most localities is the principal reason for the current interest shown in electric furnace melting for cast iron, Mr. Gregg said, adding that while the cost of coke is climbing steadily, power rates are on a downward trend.

At present, the speaker said, the cost of operating a cupola is comparable to that of electric furnace operation because cheaper material for the metallic charge can be used in the electric furnace.

Eastern New York

John M. Jones
American Locomotive Co.
Acting Publicity Chairman

THE FIRST ANNUAL CHRISTMAS PARTY of the Eastern New chapter was held at the Circle Inn, Lathams, N. Y., December 14, and had the largest attendance of any meeting yet held by this chapter.

Chapter Chairman Alexander Andrew opened the meeting by reporting on his recent visit to A.F.S. Headquarters in Chicago as a member of the National Nominating Committee. Although Mr. Andrew did not divulge the names of the nominees for A.F.S. National Directors, he said that those chosen are "all good men".

The party itself featured both amateur and professional entertainment and was highly successful in every way.

Central New York

J. A. Feola
Crouse-Hinds Co.
Publicity Chairman

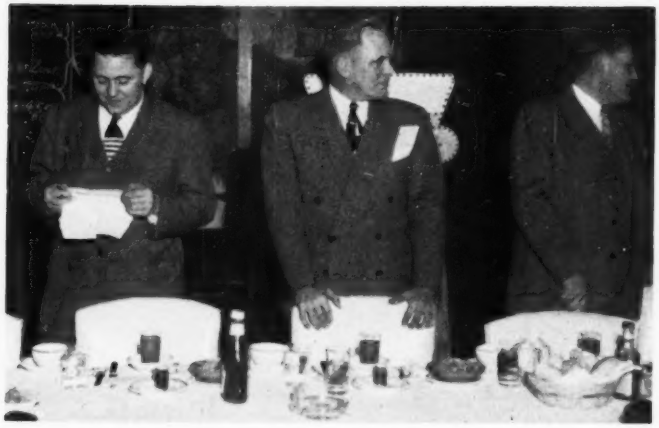
A ROUND TABLE was the feature of the November 5 meeting, held at the Onondaga hotel, Syracuse. The Malleable group postponed its sectional meeting because of the Eastern District meeting of the Malleable Iron Founders' Society in New York City.

Chapter Chairman C. M. Fletcher, the Fairbanks Co., presided at a short business meeting, introducing new members and announcing the Chapter's Eighth Annual Christmas Party, to be held December 11 at the Onondaga hotel.

The gray iron section conducted discussions on four subjects: *Carbon Control in the Cupola,* under the direction of J. O. Ochsner, Crouse-Hinds Co.; *Sand Problems,* led by Philip Sheridan; *Abrasive Problems,* headed by Bruce Artz, Pangborn Corp.; and *Patterns and Rigging,* conducted by E. H. Fiesinger, Crouse-Hinds Corp.

The Non-Ferrous group heard a talk by R. A. Colton, Federated Metals, Inc., on types of casting porosity, their causes and remedies. He was assisted in the discussion by

Speaker's Table at the Central Ohio chapter's November meeting.



About to sit down to dinner at Twin City chapter's December meeting are, left to right, Chapter Chairman Carleton C. Hitchcock, R. C. Hitchcock & Sons; Ford Snyder, Hickman, Williams & Co., speaker of the evening; and Chapter Vice-Chairman Franklin A. Austin, Crown Iron Works.

A. E. St. John, also of Federated Metals, Inc. The groups reassembled later in the evening to see a sound movie, *"Mechanization from Yard to Ladle,"* loaned to the chapter by the Whiting Corp., Hammond, Ind.

At the October 15 meeting, held at the Mark Twain hotel, Elmira, N.Y., Harry W. Dietert of the Harry W. Dietert Co., Detroit, spoke on *"Mold Atmosphere"*, using a two-reel motion picture to illustrate his lecture. Mr. Dietert first showed various stages of "burning in" at several different metal temperatures, then showed how this penetration could be reduced or eliminated entirely by "facing the mold with gas", or introducing gases into the mold cavity.

Mr. Dietert then showed a series of slide pictures of "rat-tails" and the means used to prevent them. He showed that mold hardness and permeability have direct bearing on "rat-tails" and that the establishment of controls will do much to overcome these defects.

Saginaw Valley

K. H. Priestley
Vassar Electrolay Products, Inc.
Chapter Reporter

"SAGINAW MALLEABLE IRON NIGHT" was the designation of the December 2 meeting, held at the Fisher hotel, Frankenmuth, Mich., and attended by more than 200 members and guests. Members of the staff of the Saginaw Malleable Iron Plant were individually introduced by N. J. Henke of Saginaw Malleable. Myron O. Booth of the Central Foundry Division, GMC, was technical chairman of the meeting, and James H. Smith of the Saginaw Malleable plant, was the speaker of the evening. His topic was "The Need for Foundry Educational Programs".

The foundry industry, Mr. Smith said, is beginning to feel keen competition from other fields of metal fabrication and must be "on its toes" in maintaining educational programs.

Mr. Smith stressed (1) Cooperation with colleges and universities in the teaching of important applications of castings to industry (2) Foundry educational programs for supervisory staffs, and (3) the encouraging of engineering students to enter the foundry industry.

Mr. Smith told of the many technical advancements that have taken place in the foundry industry since he first joined it, and pointed out the broad fields of development awaiting it.

Northeastern Ohio

R. H. Herrmann
Penton Publishing Co.
Publicity Chairman

"CONTROLS IN CUPOLA OPERATIONS" was the title of a talk by Ford R. Snyder, metallurgist, Hickman, Williams & Co., Chicago, given at the November 11 meeting, held at the Tudor Arms hotel, Cleveland. Approximately 250 members attended.

Mr. Snyder outlined recent developments in cupola operation, mainly from the point of view of the jobbing foundry, supplementing his remarks with blackboard

(Continued on page 87)

Jack Mott, General Electric Co., (left), J. F. Folsom of the Brumley-Donaldson Co. (center) and Robert Hongola of General Electric gathered around for a song-fest at Southern California's November dinner meeting.

NEW Foundry Products

Readers interested in obtaining additional information on items described in New Foundry Products should send requests to Reader Service, American Foundryman, 222 W. Adams St., Chicago 6, Ill. Refer to the items by means of the convenient code numbers.

Intercom Circuit

JA1—An intercom circuit which makes it possible to answer paged messages from high noise level areas clearly and intelligibly, is announced by Executone, Inc. This circuit combines a trumpet-type paging reproducer with a two-way staff station for use in intercom or sound systems. When the circuit is used to page persons in high noise level areas, page message is reproduced at high volume through trumpet station. To reply, person called depresses lever at nearest staff station. Trumpet is automatically cut out, permitting two-way conversation at voice level.

Heat Mask

JA2—Affording full face and head protection with unobstructed vision for workers in intensive heat areas, Mine Safety Appliance Co.'s heat mask is made of 30 mesh steel screen and deflects heat away from the wearer, preventing infra-red burns. For added protection an optional wool bib and snood are available. These are attached to the headpiece and cover the upper chest, head and back of neck. Weighing only 18 oz and fitted with a fiber

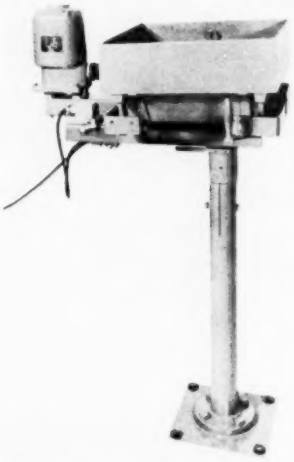
chin rest and adjustable headgear, the heat mask provides the utmost in wearer comfort. Complete details are available in Bulletin CF-23.

Wood Boring Tool

JA3—A flat-type wood bit which makes possible fast, accurate boring of holes in either soft or hard woods—at angles, through knots and without regard to grain—is announced by Rex Laboratories. Made of one-piece forged steel, the "Whiz-Bit" features a long pilot that starts and maintains boring to close tolerances. Holes can be bored in any direction. The tool operates best at speeds from 750 to 3500 rpm, although it can bore at higher or lower speeds. Available in bit-sizes from ⅜ in. to 1¼ in., the standard set consists of six bits and one countersink, in canvas case.

Roller Riddle

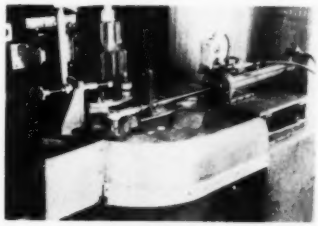
JA4—The Roller Riddle, a product of the Roller Riddle Corp. that eliminates sand riddling by hand will riddle enough



sand to cover an ordinary pattern in a 12 by 18 in. flask in two seconds. A ¼-hp, single-phase motor combined with a limit switch, automatically activates the riddle basket, oscillating 900 times per minute. Riddle basket has a sand capacity of 60 lbs and rides on rubber blocks. Roller Riddle, available in both double and single-channel types, wastes no sand and is highly flexible because of an adjustable column with 31 in. travel. Manufacturer reports that an experimental machine has operated 3000 hours, for three shifts, without mechanical failure.

Gear Hardening Machine

JA5—A completely automatic heating, quenching and indexing unit for hardening of gear teeth, one tooth at a time, by induction heating, has been developed by the Induction Heating Corp. Handling operations involve only the insertion and removal of gears. Gears which because of their size would require very large equip-



ment to be hardened into one operation, can now be done with 20 kw equipment and the use of this machine. Because of its unusual design, gears ranging from 20 in. in diameter with a 12 in. face or larger are accommodated by this unit. Machine may be mounted on conventional sink table and automatically indexes, heats and quenches each gear tooth. As an example of its economical operation, this machine will harden an entire helical gear, carbon steel, 10½ in. P.D., 3 in. face with 46 teeth to Rc hardness 50 to 54 at a cost of .205¢.

Package Conveyor

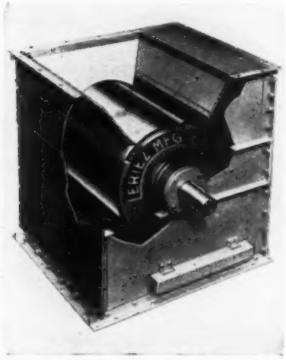
JA6—Designed to provide and increase flexibility in package handling, a new, all-aluminum package conveyor is announced by George Haiss Mfg. Co., Inc., division of Pettibone Mulliken Corp. Model 1485-A will handle bags, bundles, crates, etc., weighing up to 500 lbs at the rate of 30 per min, and is so light in weight it can be carried by three men. Readily detachable coupler unit, enables any number of conveyors to be combined into radially coupled units to carry packages around corners, over obstructions or onto elevating conveyors. Other features are radial roller on the coupler assuring proper transfer from one conveyor to another; location of belt take-up in the center of the conveyor; detachable caster units; and easily replaceable rubber pulley lagging.

Work Glove

JA7—A plastic coated and impregnated work glove, Plastigluv, is announced by the Belle City Glove Co. Full cut and comfortable, Plastigluv is claimed to give up to 10 times the wear of rubber-coated gloves, offers protection against chemicals, abrasion burns, flame, heat and liquids, has high dielectric strength and is impervious to oils.

Magnetic Drum

JA8—A completely self-energized magnetic drum requiring no electric current to produce a magnetic field is announced by the Eriez Mfg. Co. Powered by Alnico magnets, the unit is highly adaptable for the automatic removal of tramp iron and fine ferrous contamination where materials are conveyed in spouts, chutes and conveying systems not employing belts. Can be used for purifying sands, clays, powders, etc., and for separating ferrous from



non-ferrous metals. Drum separator consists of a revolving cylindrical shell within which a stationary, high-powered permanent non-electric magnet is located. The magnet covers about half the drum's cross-sectional area. Material is fed onto drum shell, and non-magnetic material is discharged separately as magnetic portion is held against shell. Unit is available in 18 different sizes, including 12, 18 and 24 in. diameters and in drum widths up to 50 in. Drum may be ordered as a separate unit or complete with housing.

Cutting Blowpipe

JA9—Reputed to be the world's largest cutting blowpipe, the Oxweld C-60, announced by the Linde Air Products Co., is especially designed for extra-heavy cutting operations, such as scrap-cutting. Cutting of steel over six ft thick has been reported. With its powder cutting attachment, this blowpipe is particularly well suited to cutting scrap having more than a normal amount of cinder and slag inclusions, which sections would be resistant to oxygen cutting by conventional processes. C-60 is a mixer-type blowpipe, with medium pressure acetylene supplied from a generator or from manifold cylinders. This valveless blowpipe has swaged nozzles of pure copper with heavy chromium plating, and its simplicity permits easy maintenance and replacement.

Drum Pump

JA10—A new drum pump that handles heavy grease or light fluids rapidly and smoothly is announced by the General Scientific Equipment Co. Special spider design of piston and intake opening provides a cut-through action and large capacity that handles any fluid which seeks its own level, except lacquer thinners. Heavy greases are pumped at rates up to three gallons per min. Smooth flow is maintained as air pressure, created by pump action, eliminates splashing and waste. Pump is easily installed and available in three models (a) with regular spout for general use (b) with shut-off valve to eliminate losses by evaporation, and (c) equipped with 8-ft grease hose.

Crucibles

JA11—Starrbide, carbon-bonded silicon carbide crucibles, the result of a new process developed by the American Crucible Co., are claimed by the manufacturer to have greater capacity for a given size than that of graphite or conventional silicon carbide crucibles, due to a wall design which allows a greater volume of melt per heat. Starrbide crucibles are available in sizes from No. 20 to No. 400, inclusive both in standard and tilting types.

Recessing Tools

JA12—Two new series of small-size Series "R" recessing tools, developed by the Maxwell Co., are comparable in capacity to standard tools in line, but extremely small dimensions permit use in applica-

tions where larger recessing tools cannot be used. Series "R" recessing tools incorporate such features as micrometer adjusting collar and positive interlock of tool-holding sections. Mandrel-built bellows type guard is furnished as standard with each tool, and hard-chromed wearing surfaces assure longer tool life. Model 1 and 2 tools have overall length of 2-13/16 and 4 in., as compared to standard tool sizes of 4-9/16 and 5¼ in., respectively. These tools are available for cutting recesses from 1/8 to 1 in. and from 1 to 2 in., and are furnished with cutter ratios of either 1:3 or 1:1. Cutters can be supplied to make multiple recesses. Cut location can be made from either top or bottom surfaces.

Metal Cleaning Compounds

JA13—Two metal cleaning compounds, Terj and Ferro-Terj, are offered by the DuBois Co., Cincinnati. Terj is an alkaline metal cleaner designed for removing light shop soils and for use in industrial washers when cleaning aluminum, and will not pit, discolor or corrode aluminum when used as a spray washer. Ferro-Terj, a heavy-duty alkaline metal cleaner, is designed to remove tenacious soils, such as drawing compounds, from steel parts, and is completelt solventized. Both cleaners are free-rinsing, leave no deposits on finished work to interfere with subsequent painting or plating operations.

Small Snow Loader

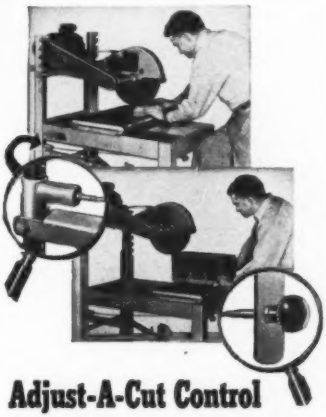
JA14—A small snow loader, designed for industrial plant storage, loading areas and parking lots, is announced by Barber-Greene Co. The Model 522 Snow Loader will load a five cu yd truck in one minute, as opposed to the usual four-man, 20-minutes' labor. One-man operated and self-feeding, Model 522 can be converted to a year-round bucket loader. Features are automatic overload release, floating boom, individual steering and crowding clutches, and spiral feeding device.

Wear Resistant Plastics

JA15—A plastic, long-life material for use in wear inserts and strips in core boxes, blow tubes, blow plates and similar applications, is Eastern Clay Products Co.'s Dura. Long-lasting, oil-resistant, non-swelling, acid and alkali resistant, resilient, non-hardening, replaceable and economical, Dura products are not affected by moderate temperatures and may be firmly cemented to metal. Available in this plastic material are Duratubes (resilient core blowing tubes), Durabuttons (wear inserts for core boxes) and Durastrips (plastic, leakproof sheets that may be cut into wear strips or wear inserts).

Masonry Saws

JA16—The 1949 masonry saw models announced by the Clipper Mfg. Co. incorporate such production speed-up features as the Adjust-A-Cut control for instantaneous one-man adjustment of the cutting head; a streamlined, ball-bearing conveyor cart—



Adjust-A-Cut Control

precision balanced and designed—with aluminum alloy castings that return the flow of water when cutting wet with Model HD-49; and a new, improved "snap-on" blade guard cover. Three separate units; cutting head assembly, saw frame and conveyor cart make Clipper saws completely portable. The nine Clipper models now permit easier and quicker cutting of all types of industrial and construction materials. For example, cutting of vitreous brick tile takes only 21 seconds, fir clay brick, 4 seconds, concrete blocks, 19 seconds, and chrome magnesite brick, 15 seconds. All models are offered on a "trial on the job basis".

FOUNDRY Literature

Readers interested in obtaining additional information on items described in Foundry Literature should send requests to Reader Service, American Foundryman, 222 W. Adams St., Chicago 6, Ill. Refer to the items by means of the convenient code numbers.

Centrifugal Castings

JA101—First detailed information on the Centri-Die Process of centrifugal casting in permanent molds is given comprehensive treatment in Lebanon Steel Foundry's bulletin, *Centri-Die Castings*.

The 12-page illustrated booklet describes the process perfected in Britain for wartime production of jet engine parts, and which is one of the most important recent advances in the casting of carbon, special alloy and stainless steel alloys for severe heat resistant and corrosion resistant service. Text and pictorial data describe uniformity of metal structure, metal conservation, production economics, finishing procedures and inspection methods under the process, whose principal advantages are (1) higher quality castings of greater density (2) readily achieved production of assorted parts and complex structural shapes that cannot be satisfactorily cast by static methods (3) uniformity of casting strength throughout, a characteristic not applicable to forgings and (4) use of alloys difficult or impossible to forge. Copies of the bulletin are available without charge.

Vibrating Machinery

JA102—Bulletin 115-A, "Gyrex Vibrating Screens", published by Robins Conveyors Division of Hewitt-Robins, Inc., replaces obsolete Bulletin 115 (index Vibrating Machinery) for the company's series of binder inserts. The 16-page illustrated brochure describes in detail the operating features, structure and component parts, types and sizes of screens, attachments, advantages and applications of Robins' new Gyrex Vibrating Screens, durable, general-purpose, positive-stroke screens with a wide variety of applications.

Primers

JA103—Latest recommendations for the formation of corrosion inhibitive primers for the protection of atmospherically exposed iron and steel are presented in Red Lead Technical Letter No. 3, published by the Lead Industries Association. Eleven different formulations have been selected by the Association, on the basis of outstanding performance under actual field conditions. Both oil vehicle and fast-drying synthetic resin vehicle paints are included to cover a wide range of applications and exposure conditions for shop or field priming of structural steel and other ferrous metals. In addition to general structural steel work, such specific applications as bridges, water storage tanks, railroad cars, structural work on dams, ship superstructure, pipelines and mine equipment are suggested. Copies are available free of charge.

Reducing Valves

JA104—Bulletin No. 265 describes the Cash-Acme Type B Pressure Reducing and Regulating Valve and gives recommendations and regulations covering installations, and contains capacity charts for water, air and steam.

Cupola Patching

JA105—Ironton Fire Brick Co.'s Information Circular No. 21, "Cupola Patching", contains a complete description of the latest methods of repairing cupolas. Described are slag removal, plugging of linings and types of cupola blocks, patching materials, refractory daubing muds, and prepared plastic ramming refractories for various cupola patching applications.

Phenolic Liquid Resin

JA106—G-E No. 12300 Phenolic Liquid Resin for foundry core binding is described in a technical report recently issued by General Electric Co.'s Chemical Department. Advantages, mixing instructions and costs are listed. G-E No. 12300 phenolic liquid resin is a soft-baking sand core binder, which is said to speed-up core production and improve castings, with fewer rejects, and is made up of 70 per cent phenolic resin solids and 30 per cent water. It has a specific gravity of 1.2 and a viscosity of 100-150 cp. Binder may be mixed with core sand in muller or diluted and used as a sand spray.

Surfacers and Grinders

JA107—"Surfacers and Grinders" is the title of a folder recently published by Buehler, Ltd., describing the company's wet power grinders, belt surfacers, bench grinders and Duo-Belt wet surfacers. Specifications, applications and prices are given for each product. Detailed photographic illustrations of each of Buehler's surfacing and grinding products for the metallurgical laboratory are shown.

Rectangular Magnets

JA108—A 12-page illustrated catalog describing Dings Triple Pole High Intensity Rectangular Magnets for the prevention of tramp iron damage to equipment, protection against fires, explosions, product contamination and recovery of tools and scrap, has been published by the Dings Magnetic Separator Co. Bulletin illustrates uses of various types of magnets, and the advantages and applications of each. Catalog 301-A available on request.

Alloy Steel Chains

JA109—"Inspection, Care and Use of Taylor Made Alloy Steel Chain", is the subject of a booklet recently issued by the S. G. Taylor Chain Co. Contents include a check list for chain inspection, proper use of chain, maintenance, maximum wear limits for each chain diameter, and safe working load limits.

Universal Tester

JA110—A four-page bulletin recently released by W. C. Dillon & Co., illustrates and describes the Model "L" Universal Tester—a precision instrument of seven different ranges for testing materials with tensile strength from a few pounds to 160,000 lb sq in. The bulletin uses photographs to show simple construction for tensile, compression, transverse and shear testing; describes the handling of flats and rounds; and illustrates the easily-read, interchangeable dynamometers.

Gas Analyzer

JA111—Latest addition to Burrell Technical Supply Co.'s group of Bulletins describes Burrell Industro Gas Analyzers, their applications, operating procedures, and structural features. Working diagrams and photographs of each model are shown. Also included are listings and descriptions of the Burrell Carbon Dioxide Indicator, sampling tubes, combustion indicators, thermometers and solutions.

Metallizing Motors

JA112—Each issue of the Metco News, house organ of Metallizing Engineering Co., Inc., will henceforth feature an article showing how metallizing can reduce the cost of motor maintenance. Already available free-of-charge are copies of the September issue, containing an article illustrating how an armature shaft or bell end can be restored for only 10 per cent of replacement cost by means of the Metco Metallizing Process. Ask for Volume 4, Number 4, Metco News.

APEX
ALUMINUM AND MAGNESIUM
Research leadership back of every Ingot
Whatever the method of casting—sand, permanent mold, or die casting—you're sure to agree on this basic fact: it takes good ingot to make good castings. That's why the Apex research department constantly works to make better alloys . . . why so many successful foundries always order Apex Ingot—proved best in every test from Ingot to Casting!
Apex Smelting Company
Chicago • Cleveland
2537 WEST TAYLOR STREET, CHICAGO 12, ILLINOIS
6700 GRANT AVENUE, CLEVELAND 5, OHIO

FOUNDRY FIRM *Facts*

Textile Machine Works' Foundry Division, Reading, Pa., has installed a completely mechanized unit which provides straightline production methods from sand handling to finished casting. The new mechanized unit in "the largest foundry under one roof in the world" incorporates every possible feature for comfortable and efficient production of castings, including electrically-controlled mullers, bucket elevators, overhead sand belt conveyors, manually-set adjustable plows to deliver sand to molders, air-controlled molder hoppers, air-operated jolt-squeeze molding machines, spill grates that drop excess sand to underground conveyor belt for re-use. Roller conveyor carries aluminum pallets for completed molds. Molds are then conveyed to pouring zone after being placed in jackets and weighted. Two cupolas serve the 27 molding stations where iron is received in one-ton bull ladles carried on monorail conveyors to transfer point, where molds are poured continuously as they pass on a conveyor. Cooling hood removes fumes, then magnetic, air-operated lifting mechanism lifts weights and returns them to station. At the station, where packets are removed, another ventilated hood removes remaining gases and molds are dumped from pallet to underground station, where pallets are conveyed back to molders for re-use. Castings travel on underground conveyor belt to final shakeout screen and are dumped into tote box. Magnetic separator removes metallic refuse from sand, which is again screened and returns to storage bin. Dust is collected by wet-type collectors and exhausted in the form of sludge.

Chain Belt Co., Milwaukee, announces the establishment of a new Atlantic warehouse at 878 Ashby St., N. W., Atlanta, Ga., where the Atlanta district offices will be located under Manager J. S. Moore. G. H. Schuelke will supervise the warehouse, which will serve the entire Southeast. A 24-hour delivery service will be available to most parts of the territory served. Products of the company's Chain and Transmission division, Baldwin-Duckworth division and Conveyor and Process Equipment division will be stocked.

The Claude B. Schneible Co., Detroit, has appointed the **Engineering Service Co.,** Newark, N. J., as its representative in northeastern New Jersey. Factory trained and experienced ESCO engineers are prepared to analyze all foundry, chemical processing plant, and other plant smoke, fume and air contamination problems and recommend the exact Schneible system, consisting of Multi-Wash Collectors, ducts, hoods, etc., to overcome these problems.

Grand Industries, Inc., is the new name of the **Cleveland Co-Operative Stove Co.,** according to a recent announcement. The company's vitreous enameling division will in the future be operated under the trade name, **Grand Enameling Co.** Other divisions will retain their old names—Cleveland Foundry Co., Cleveland Distributing Co., and Grand Home Appliance Co.

Kaiser-Frazer Corp., Willow Run, Mich., has entered into a contract with the **Phoenix Apollo Steel Co.** to purchase its Phoenixville, Pa., plant, at an estimated cost of more than $3 million. The purchase, which includes the Phoenix Bridge Corp., will enable Kaiser-Frazer to turn a substantial portion of its pig iron supply into semi-finished products for automotive use. Physical assets of the plant include six open-hearth furnaces, a blooming mill, two finishing mills and a structural steel mill. Present monthly output is about 26,000 tons of finished and semi-finished steel products.

Manhattan Rubber Division of Raybestos-Manhattan, Inc., Passaic, N. J., recently celebrated its 55th anniversary. Organized in 1893, the Division is an offshoot of the Roxbury Rubber Co., Boston, founded in 1833—the first chartered rubber company in America. Today the Division employs about 4,000 persons and is one of nation's largest producers of materials handling equipment.

Algoma Steel Corp., Ltd., announces that its offices have been moved from 25 King Street West, Toronto, to the Bank of Montreal Bldg., 50 King Street West.

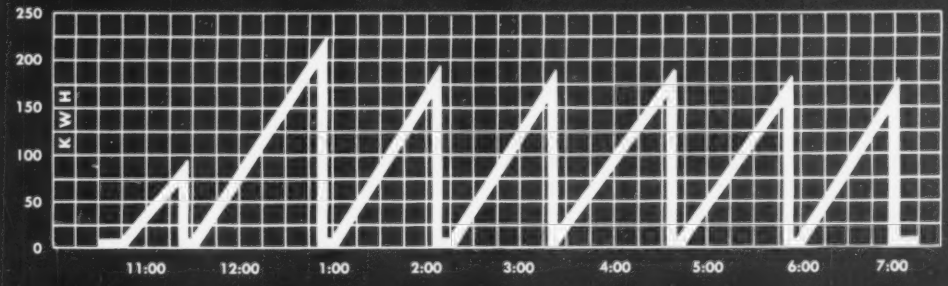
Wheelco Instruments Co., Chicago, announces the opening of a new district office at 2204 Fannin St., Houston 5, Texas. The office is under the direction of George Hatfield, formerly of the Chicago sales office and will handle sales and service for Texas, Louisiana and New Mexico.

Moore-Handley Hardware Co., Inc., Birmingham, Ala., announces that construction is underway on a warehouse and office at Nashville, Tenn., and that a warehouse in Mobile, Ala., is being remodeled as a modern warehouse and sales office. Covering an entire block, the Mobile branch will feature the latest developments in electric materials handling equipment, including an overhead crane.

Pacific Graphite Co., Oakland, Calif., has been appointed Northern California representative for the **Tabor Manufacturing Co.,** Philadelphia. Pacific will cover all of California north of Fresno.

Displayed on both the plant and trucks of the Great Lakes Mfg. & Foundry Co., Wyandotte, Mich., signs call the public's attention to the slogan of the Gray Iron Founder's Society—"Make It Better With Gray Iron."

DETROIT ROCKING ELECTRIC FURNACE



One month's operation of type LFY, 175 KW, 700 lb. nominal cold charge capacity Detroit Rocking Electric Furnace. High strength, alloy automotive irons poured at 2800-3000° F.

• No. heats per day—7 • Av. heat weight—1000 lbs. • Total lbs. cold melted—168,930 • Av. power consumption, including preheat—549 KWH/ton • Av. power cost @ 1¼c/KWH—$6.86 • Av. electrode consumption—4.15 lbs./ton • Av. Electrode cost @ 22c/lb.—$.913/ton • Av. no. heats/lining—253 (9-month average) • Av. refractory cost—$3.64/ton.

NOTE: *Operator handles two such furnaces all day. Furnaces are equipped with automatic electrode control as well as automatic rocking control.*

FASTER, CHEAPER, BETTER MELTS IN SINGLE or MULTIPLE OPERATION

Detroit Rocking Electric Furnaces achieve increased production at reduced costs, with rigid control over quality.

The above operating graph of a type LFY, 175 KW, 700 lb. nominal cold charge capacity Detroit Rocking Electric Furnace melting high strength alloy automotive irons is typical of one day's economical operation. Multiply this day's savings by the working days of the year and you realize the owner's great savings.

Besides optimum power use, all-electric operation precludes handling and storing messy, bulky fuels. Equally advantageous is the positive control of operational speed, composition quality and other melting factors. Out-of-production time due to burned-out linings is minimal. Spare, previously-lined furnace shells are quickly, easily installed.

Other saving features are fast, uniform outputs; lowest metal loss by shrinkage; conversion of shop borings and turnings with least loss from oxidation. The arc is automatically established clear of the molten bath at all times. The metal is never a part of the electrical circuit, assuring uniform temperatures within the melting chamber.

Detroit Rocking Electric Furnaces are available in 10 to 4000 lb. capacities with either conical or cylindrical chambers. Individually designed to meet your plant electrical specifications.

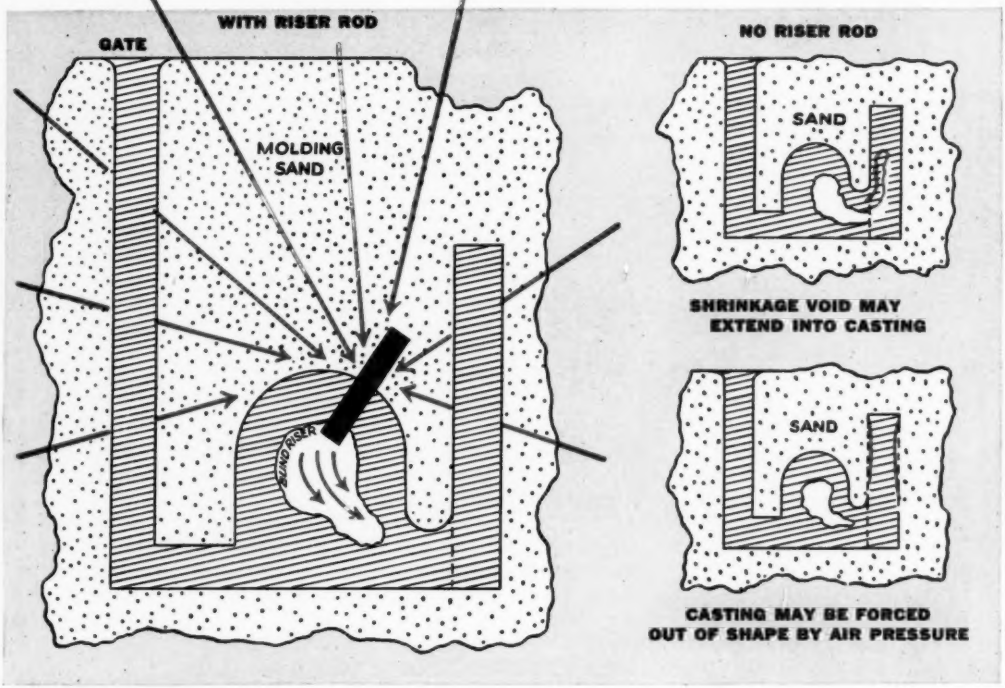
Whether you melt ferrous or non-ferrous metals, send us your production data. Our engineers will furnish you facts on how you gain ultimate operating economy with positive melt-quality control, using the Detroit Rocking Electric Furnace suited to your requirements in size, capacity and use. Address:

DETROIT ELECTRIC FURNACE DIVISION

KUHLMAN ELECTRIC CO. • BAY CITY, MICHIGAN

Air pressure feeds your casting with sound metal!

(WHEN YOU USE "NATIONAL" GRAPHITE RISER RODS)



●By inserting a "National" graphite riser rod into the mold—as shown above—you keep the blind riser open to the atmosphere during solidification of the metal. The red arrows show how air pressure pushes powerfully through this hole. It forces molten metal into the casting with considerable force.

The result: Air pressure works *for* you—not *against* you. Air pressure does not warp the casting out of shape, as it might if there were no riser rod to relieve the internal shrinkage. Air pressure packs metal where a vacuum tries to exist, and the shrinkage void is left in the riser...not in the casting. The result is a sound, true-to-shape casting.

You can buy "National" graphite riser rods in standard sizes... from the smallest to the largest. They reach you in a handy package, all ready to place in the mold. "National" graphite riser rods save time because they are so easy to use. They do a better job than other rods because they keep riser metal fluid longer—force-feed more metal into the casting.

The term "National" is a registered trade-mark of

NATIONAL CARBON COMPANY, INC.

Unit of Union Carbide and Carbon Corporation

UCC

30 East 42nd Street, New York 17, N. Y.

Division Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco

CHAPTER ACTIVITIES

(Continued from Page 79)

diagrams and illustrations, and distributed a typewritten list of standard melting practice instructions.

An additional feature at the meeting was a sound motion picture, *"Gating Systems for Metal Castings"*, shown by courtesy of the Naval Research Laboratory, Washington, D.C. High-speed photography reveals that gating systems do not function as commonly supposed. The film shows exactly what does happen, also the effects of gate design on flow and turbulence of liquid metal when poured into a mold. William G. Gude of Penton Publishing Co. led the discussion.

At the patternmakers' session some 50 members and guests heard Louis Schmidt, Aluminum Company of America, discuss the planning of pattern equipment.

With the help of colored drawings, Mr. Schmidt described the assembling and pouring of a large mold composed almost entirely of dry sand cores. A base measuring 72 in. in diameter and 33 in. high for a piece of radar equipment was cast in the mold.

The cores weighed six tons and two men required 2½ days to assemble the mold. It was poured in three minutes, allowed to cool for 12 hours and required 12 hours for knocking out the 1000-lb. aluminum casting. Two thousand pounds of molten metal were required, Mr. Schmidt said.

Edward Glosner, Modern Pattern Co., was the discussion leader.

Northwestern Pennsylvania

James J. Farina
American Sterilizer Co.
Chapter Reporter

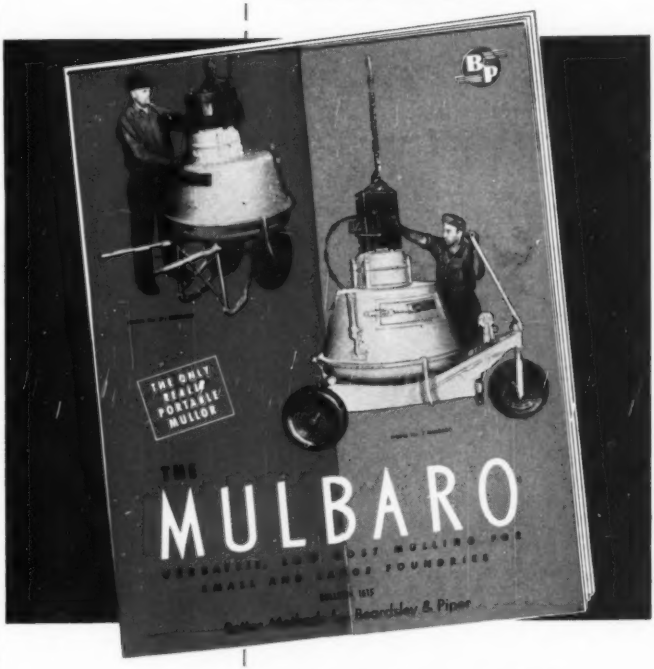
ERIE CITY COUNCILMAN Michael A. Cannavino, an accomplished amateur magician, entertained members of the chapter with an amusing exhibition of his bag of tricks following dinner at the November 22 meeting, held in the Blue Room of the Moose Club, Erie.

The coffee talk speaker was William I. Arbuckle, Captain, Military Intelligence, Reserve, whose subject was "I Met the Russians in Czechoslovakia". Mr. Arbuckle, whose talk was sponsored by the Reserve Officers' Association, outlined his own experiences and those of the

(Continued on Page 88)

GET THIS NEW

MULBARO CATALOG



The Mulbaro is a product of Beardsley & Piper, manufacturers of the Sandslinger • Speedslinger • Speedmullor • Screenarator • Plate Feeder • Sand Conditioning Machine • Champion Speed-Draw • Turn Table.

A new Mulbaro catalog . . . completely describes the advantages and operation of the Mulbaro . . . a versatile, low cost, portable mullor for small and large foundries. Easy to operate—just plug in and push the button! Fast and thorough in mulling, the Mulbaro is the only really portable mullor and is outstanding in flexibility, low initial cost and economy in operation. Be sure to send for your catalog now!

Send Coupon Now!

BEARDSLEY & PIPER
Division of Pettibone Mulliken Corp.,
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Send me the new Mulbaro Catalog!

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ATTENTION _____
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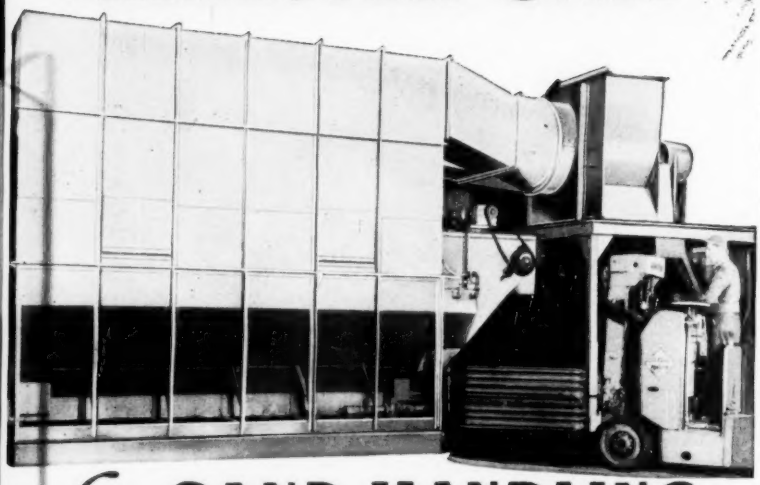
CITY _____ ZONE ____ STATE _____
A

Announcing
THE BEST INVESTMENT IN DIRT AND DUST CONTROL YOU CAN MAKE!
Schmieg NEW
Stainless Steel
ARRESTER UNIT



for SAND HANDLING
and SHAKEOUT

Because it is made of stainless steel and *because* it is designed and manufactured for longer, corrosion-free operation, the new Schmieg 30,000 C.F.M. Centri-Merge Swirl Type Arrester illustrated is the best buy on the market. Stainless steel is your guarantee of long-range low maintenance costs. A Schmieg unit is easily installed to occupy a minimum of valuable floor space for the most efficient removal of dust and dirt from shakeout stations, sand handling and conditioning systems. Sludge disposal is perfectly simple—you use nothing more than a skid on a lift truck. We urge you to consider carefully the *dollar-saving advantages* of an investment in a Schmieg stainless steel Arrester Unit.

Consult Schmieg engineers regarding your problems of dust and fume control.

THE *best* AIR PURGE is CENTRI-MERGE

Schmieg INDUSTRIES INC.
Engineers & Manufacturers
3800 PIQUETTE AVENUE • DETROIT 2, MICHIGAN

Army in dealing with the Russians. His talk was particularly interesting in view of the present unsettled European situation.

C. V. Nass, vice-president of the Beardsley & Piper Division of the Pettibone-Mulliken Corp., Chicago, technical speaker of the evening, had as his subject *"Progress in Mulling"*, supplemented by the showing of lantern slides. Following Mr. Nass' address, there was a lively question-and-answer session.

Missouri School of Mines

John Absalom
Chapter Reporter

THE LOCAL STUDENT CHAPTER was host to members of the St. Louis District chapter at its November meeting, when A.F.S. National Director Bruce L. Simpson was introduced as the speaker of the evening by President A. L. Hunt.

Mr. Simpson's talk covered the history of the casting industry from the first discovery of formable metal by man to the modern foundry. Many slides were shown which pictured the progress of furnace development and the art of casting in both ferrous and nonferrous foundry work. The importance of the foundry was shown by the fact that the position nations have held in the history of the world coincides with the skill and knowledge that they have had in the reduction, forming and application of metals.

An autographed copy of Mr. Simpson's book, DEVELOPMENT OF THE METAL CASTING INDUSTRY, was won as a door prize by Sidney Silver of the School of Mines chapter.

During the short business meeting that followed, Mr. Hunt announced that the St. Louis group had collected all the necessary equipment to set up complete small scale foundry shop at the School of Mines. This equipment includes a gas-fired, 40 pound crucible furnace, molding equipment, ladles, patterns, pattern making equipment and sand.

James Reynolds announced that a series of papers on some phase of metals casting would be given by members of the local chapter at the next meeting on December 13. The student with the prize winning paper will receive ten dollars and the paper will be submitted to AMERICAN FOUNDRYMAN.

Metropolitan Chapter

George Baer
Atlas Foundry Company
Publicity Chairman

ON FRIDAY EVENING, December 10, the Metropolitan Chapter of the American Foundrymen's Association held its annual Christmas Party at the Essex House in Newark, N. J. Approximately 500 foundrymen sat down to a very enjoyable dinner. After dinner, about 100 door prizes were awarded.

Eastern Canada & Newfoundland

W. J. Brown
Robert W. Bartram, Ltd.
Publicity Chairman

"PAST PRESIDENT'S NIGHT" was the designation of the chapter's November 12 meeting, honoring past chapter presidents and attended by several foundrymen prominent in A.F.S. affairs.

Opening the proceedings, Chairman O. L. Voisard, Robert Mitchell Co., Ltd., asked R. W. Bartram, Robert W. Bartram, Ltd., to speak on the history of the Eastern Canada & Newfoundland chapter.

According to Mr. Bartram, one of the "prime movers" of the chapter, prior to 1941 two previous attempts, one in 1937 and one in 1939, were made to form a chapter, but owing to trade conditions little interest was evidenced and efforts were unsuccessful.

Late in 1941, Mr. Bartram was approached by Harold J. Roast, then an A.F.S. National Director and now an Honorary Life Member of the Society on the subject of forming a chapter. Soundings were again made, this time with more promising results.

During a monthly meeting of the local chapter of the American Society for Metals, a special meeting was called for the foundrymen present. During the meeting Mr. Bartram called upon Mr. Roast to outline the benefits of A.F.S. membership. He was followed by D. J. Reese, International Nickel Co., New York, the evening's speaker at the ASM meeting. After a short discussion, the 47 foundrymen present unanimously agreed to form a chapter and an organization committee was appointed under Mr. Bartram.

An understanding covering the transfer of local members was reached with the A.F.S. Ontario

"FALLS BRAND" ALLOYS
AMERICA'S LARGEST PRODUCERS OF ALLOYS

"FALLS"
50-50
NICKEL COPPER

Production costs are materially reduced through the use of "FALLS" 50-50 NICKEL COPPER. Savings include:

... increased output

... less fuel consumption

... fewer rejected castings

... longer life for crucibles and furnace linings.

WRITE FOR COMPLETE DETAILS

NIAGARA FALLS
Smelting & Refining Division
Continental Copper & Steel Industries, Inc.
BUFFALO 17, NEW YORK

chapter. Chapter regional boundaries were set, and by April, 1942, membership had grown to 72.

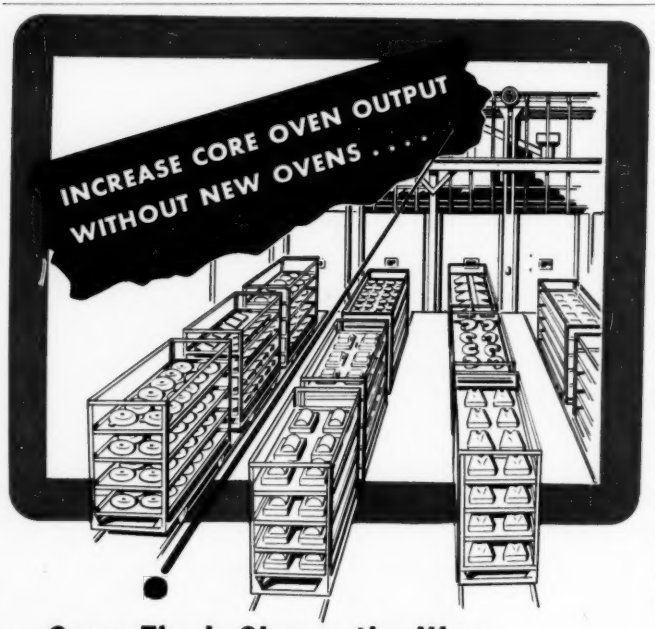
On July 23, the first organizational meeting was held and the first Executive Committee elected, with Charles C. Brisbois as chairman. In recognition of Mr. Bartram's efforts, he was voted Honorary Chairman. Today, the chapter membership stands at 322, seventh in size among A.F.S. Chapters. E. N. Delahunt, A.F.S. National Director and a past chapter chairman, reviewed the outstanding work done in the chapter's Apprentice Training Course and educational work, which, he said, has aroused other chapters to greater efforts, and cited particularly the wonderfully successful Technical Papers Contest sponsored by the chapter.

Past Chapter Chairman R. Bernard (1943-44), J. Gosselin & Co., Ltd., sent a message to the meeting, stressing the necessity for loyalty and hard work as a means of bringing down current costs.

Past Chairman G. Ewing Tait (1944-45), Dominion Engineering Works, Ltd., spoke on competitive industries. This competition, he said, can only be met by producing better and cheaper castings. To reach this goal, competent personnel is a necessity, and must be attracted to the industry.

Past Chairman Henri Louette, Warden-King, Ltd., spoke on "*What We Are Doing In Our Plant.*"

Past Chairman A. H. Cartwright of Crane & Co., Ltd., said that the chapter needs to enroll more patternmakers and concluded by pointing out there should be greater understanding between metallurgists and supervisory personnel.



Swan-Finch Shows the Way

Limited core oven capacity was seriously holding up the foundry and hampering production in a large mid-western plant. New core ovens would have meant a costly investment.

A Swan-Finch representative was called in to discuss the problem. After conducting tests on actual work in process he recommended specific mixtures of Safco 412 Core Oil and Tykor Compound.

Result: Instead of the usual two cycles required for the large cores, baking time was cut to one cycle of 1-hour 15-minutes at 450°F. Small cores came through without critical overbake . . . shakeout was good . . . sand worked smoothly in boxes and blowers . . . cores drew clean and . . . *a considerable investment for new equipment was eliminated.*

Call in a Swan-Finch representative to analyze your problems. His visit may show you the way to important savings in your core room and foundry.

SWAN-FINCH OIL CORPORATION

Washington

Harold R. Wolfer
Puget Sound Naval Shipyard
Chapter Reporter

"CARBON CONTROL IN THE CUPOLA" was the subject of a talk by W. W. Levi, metallurgist, Lynchburg Foundry Co., before the November 19 meeting of the Chapter. The objectives in cupola melting, Mr. Levi pointed out, are hot iron, speed in melting and proper composition. He stated that the use of kindling tuyeres, at or near the bot level, have been effective in getting hot iron from the start.

Lynchburg Foundry also finds that flux on the bed charge, that is, limestone in amount equal to that used for three charges plus ¾ lb. flux per square foot cupola area, helps to insulate the first top of iron as it accumulates in the well. The regular amount of limestone is used on the first charge of iron along with 6 to 8 lbs. of a flux per ton of metal. No flux, other than limestone, is charged in the cupola after this first charge.

Composition of iron melted in the cupola is controlled very closely in their foundry. He considers carbon to be the most important element to control in the melting of cast iron. Even in alloy cast irons, the alloying elements influence the condition of the carbon, thereby determining properties of the castings. In order to pour a great variety of castings, their foundry runs a base iron with silicon content to suit the heavy castings and silicon additions are made at the spout for castings of lighter sections. (Small addition of chromium may also be

used to further adjust mixture for heavy sectioned castings.)

Close control of carbon is made possible by knowing analysis of pig iron and cast scrap entering charge. Base charges are calculated so that carbon entering charge is known. (Analyses for carbon at the spout are run every 30 minutes and for silicon, sulfur and manganese, every hour.) Fluctuations in carbon content of metal at spout are compensated for to maintain balance between carbon and silicon using following equation: C E = T. C. + 3 Si + P. An increase of .10% total carbon, for example, would be compensated for by decreasing the Si + P by three times that amount.

From records of results over a long period, Mr. Levi has worked out a straight line graph on which "carbon in" (calculated in charge) is plotted against total carbon at the spout. These calculations show that: "carbon out" = 1.85% + ½ "carbon in" based on a silicon at spout of 2.00 per cent.

Mr. Levi stressed the desirability of coming out with lower silicons at the spout to enhance carbon pickup in the cupola. Since silicon is a graphitizer, tending to throw carbon out of solution, it is reasonable to expect that higher silicons would retard carbon pickup. Mr. Levi calculates that lowering silicon in charge will increase carbon pickup by one fourth the amount of silicon reduction. (It is considered good practice, when striving for good carbon pickup, to bring iron out at 1.60% silicon and then build up 2.00% silicon at spout.)

Other factors favoring carbon pickup pointed out by Mr. Levi were, high temperature, fast melting rate, dry blast, and good quality coke of high carbon content.

Twin City

J. D. Johnson
Werner G. Smith Co.
Chapter Reporter

"Controlling cupola operations", a talk by Ford R. Snyder, metallurgist, Hickman, Williams & Co., Philadelphia, given before the December 2 meeting of the chapter, attended by more than 100 members, stressed the basic steps of cupola starting and operation.

The need was cited for establishing a "Standard Practice Instruction" sheet and adhering to its out-

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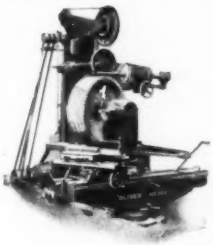

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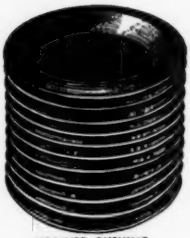

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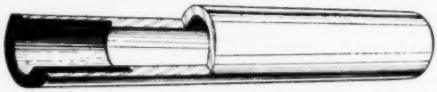

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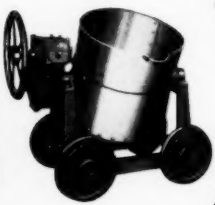

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line faithfully. Any changes that are then needed are first altered on the instruction sheet and then tried in the operation of the cupola. Through this medium, any new ideas or developments can properly be evaluated.

Two important points brought out by Mr. Snyder were: (1) Proper control in cupola operations should begin at the top of management to be effective. (2) Provide competent supervision of changing operations, someone with proper qualifications and armed with ample authority.

A most interesting discussion of the evils of improper charging showed this to be a direct cause for shell born-through, excessive refractory burn-out, oxidation of the metal, low tapping temperatures, excessive use of coke and fluxes, and erratic chemical analyses. Two case histories were related wherein all of the above conditions existed. Proper charging and minor procedure changes resulted in cures or corrections for all of the conditions.

Canton District

H. C. White
United Engineering & Foundry Co.
Chapter Reporter

"FOUNDRY MECHANIZATION", a talk by C. O. Bartlett, sales manager of the C. O. Bartlett & Snow Co., Cleveland, was heard by some 80 members and guests at the December 2 meeting.

The speaker traced the history and development of mechanization from its beginning—wheelbarrows and tote boxes—to the highly mechanized handling units of today. Every foundry operation, from the making up of the cupola burden through the various operations of melting, molding, pouring, shakeout cleaning and shipping was discussed in the light of modern mechanization to show how to speed up production to meet competition.

The speaker also tied the problem of mechanization to the vital problem of labor relations, by stating that mechanization will not decrease the total number of personnel needed in the foundry, but would increase production and efficiency while reducing fatigue. In so doing, Mr. Bartlett said, absenteeism and labor turnover would be held to a minimum.

(Continued on page 94)

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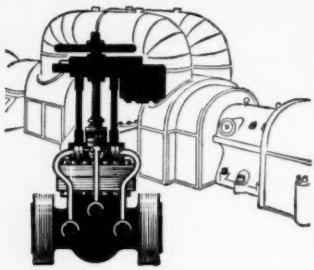

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CHAPTER ACTIVITIES

(Continued from page 92)

A.F.S. National Director Norman J. Dunbeck, Eastern Clay Products, Inc., Jackson, Ohio, spoke briefly to the membership on A.F.S. activities and issued an invitation to the Ohio Regional Conference, to be held in Columbus, March 11-12.

Massachusetts Institute of Technology

James Veras
Technical Secretary

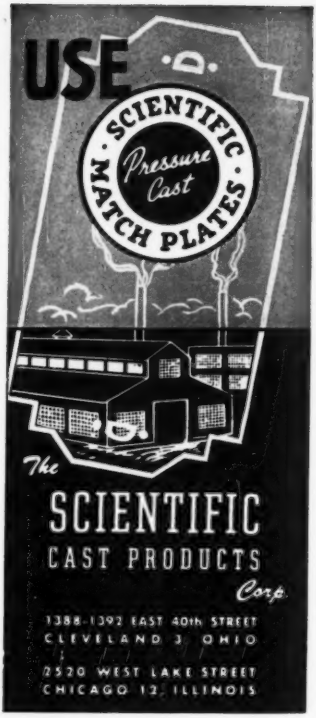
"THE FUTURE OF COLLEGE GRADUATES IN THE FOUNDRY FIELD" was the title of a talk by George K. Dreher, executive director, Foundry Educational Foundation, who spoke to members of the student chapter at M.I.T.'s Foundry Laboratory, November 9, following a dinner held on the campus.

Mr. Dreher prefaced his discussion with an explanation of FEF's reasons for being, its objectives, and its accomplishments. He pointed out that FEF was created when the industry was in great need of skilled men of college calibre and a negligible percentage of these men sought foundry careers. The FEF set out to attract such men to the foundry field.

This, he said, is now being accomplished by the granting of generous scholarships, promotion of the industry's welfare throughout the country, and development of methods to provide better instruction in schools. Interest shown by company officials in the young engineers, the need for considering wage differentials with respect to regional living costs, and providing worthwhile facilities are some of the features which the FEF considers important to the young engineer and which it emphasizes for adoption by the industry.

It was Mr. Dreher's belief that opportunities are limitless today. He pointed out that normal requirements of a 350-man plant on the managerial level, call for 19 college-trained men who are expected to have some metallurgical background, some experience in foundries, and have undergone a 12 to 18-month transition period from student to industrialist.

Mr. Dreher indicated that there are approximately 2000 openings every year on the college level which offer jobs in varied catego-



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ries. Classification to a specific job is determined by the individual's personality, the organizational set-up and size of the company. The speaker concluded by outlining the personal qualities expected of young engineers, such as being useful, temperate, loyal, progressive, healthy, neighborly, and a constructive citizen. The evening's proceedings ended with a discussion.

Birmingham District

J. P. McClendon
Stockham Pipe Fittings Co.
Chapter Reporter

"STRUCTURE CONTROL OF CAST IRON" was the subject of an address by Alfred Boyles, metallurgist, U. S. Pipe and Foundry Co., Burlington, N. J., and author of several technical papers recently compiled in book form, at the November meeting of the chapter.

Mr. Boyles discussed structure control of gray iron based on his well-known work, *"The Structure of Cast Iron"*. Factors affecting the primary structure were presented in detail on such topics as influence of cooling rate on the primary dendritic pattern, and cell structure of the eutectic and graphite flake size. Various types of graphite flake structures were discussed and were illustrated by numerous slides. The effect of undercooling and inoculation as well as other topics of interest to the gray iron metallurgist and foundryman provided for a lively "question and answer" session after the formal presentation of the paper.

Dr. James T. MacKenzie, chapter chairman, presided over the meeting of the board of directors at a dinner which preceded the technical session. Reports from committee chairmen indicated that plans are well under way for the Seventeenth Annual Foundry Practice Conference, to be held in Birmingham at the Tutwiler Hotel, this coming February 17, 18, 19.

T. H. Benners, Jr., National Director of A.F.S., attended the board of directors meeting as representative of A.F.S. Headquarters and brought up several items of interest. Samuel Carter, assistant melting superintendent, American Cast Iron Pipe Co., introduced the speaker and conducted the discussion period in the absence of C. P. Caldwell, program chairman.

Eastern Canada & Newfoundland

William J. Brown
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Chapter Reporter

"MOTION PICTURE NIGHT", was the designation of the December meeting when two interesting films were shown through the courtesy of the Meehanite Metals Corp. Prior to the showing of the films C. E. Harrington, manager of the Meehanite Sales Engineering Department, sketched a brief history of Meehanite, showing how the processes and procedures have been extended today.

The first film, entitled *"Flow of Metal into Molds"* showed the progressive solidification in the mold. The second film was entitled *"Meehanite Means Better Castings"*. After the showing of the films, Mr. Harrington answered a barrage of questions from the audience.

W. T. Shute, chairman of the chapter's Educational Committee, addressed the meeting in French and English, announcing the local contest for apprentices to be held January 29 and February 5 in patternmaking and molding. Attention was drawn to the annual competition, open to all members, for the best paper dealing with a technical subject on the foundry industry.

Chesapeake

Jack H. Schaum
Naval Research Laboratory
Chapter Reporter

THE OCTOBER MEETING of the Chesapeake chapter featured a slow motion colored film showing the flow of molten steel in various designs of whirl gates, riser gates, finger gates, horn gates, and step gates. This motion picture was produced at the Naval Research Laboratory by W. H. Johnson and W. O. Baker. The pictures proved undesirable turbulence to be present in castings poured with these conventional gating systems. The least turbulence resulted when using a bottom side gate which consisted of a trap placed in the gating system in advance of the casting, thereby decreasing the velocity of the incoming metal so that it enters the mold more evenly.

Preceding the technical session, Dr. Tracy Jarrett presented a coffee talk and a series of color slides describing a trip he made to Utah.

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Electro Metallurgical Co. . . 14
Federal Foundry Supply Co. 1, 93
Federated Metals Div., American Smelting & Refining Co. 4
Great Lakes Foundry Sand Co. 19
Industrial Equipment Co. . 92
International Nickel Co. . . 21
Jackson Iron & Steel Co. . . 91
Kirk & Blum Mfg. Co. . . . 16
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Niagara Falls Smelting & Refining Div., Continental United Industries Co., Inc. . 89
Oliver Machinery Co. . . . 91
Pittsburgh Lectromelt Furnace Corp. . . Cover II
Schmieg Industries, Inc. . . 88
Schneible, Claude B., Co. . . 5
Scientific Cast Products Corp. 94
Silverstein & Pinsof, Inc. . . 13
Smith, Werner G., Co. Cover III
Swan-Finch Oil Corp. . . . 90
Thiem Products, Inc. . . 8, 9
Union Carbide & Carbon Corp. . . . 14, 86
U. S. Graphite Co. 7
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Viener, Hyman, & Sons . . 91
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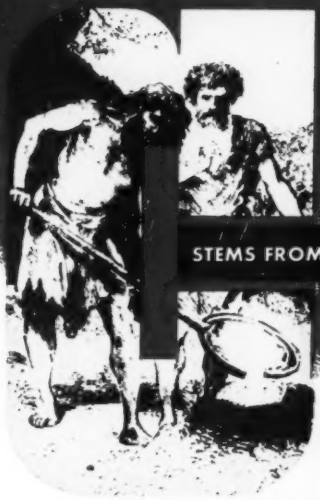

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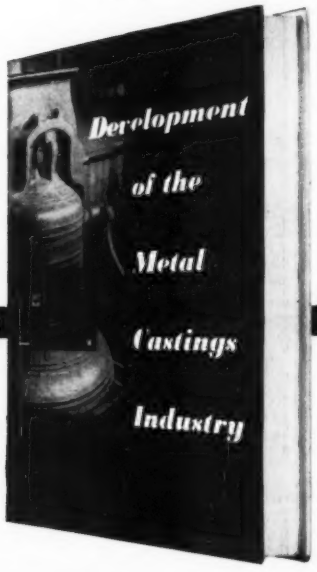

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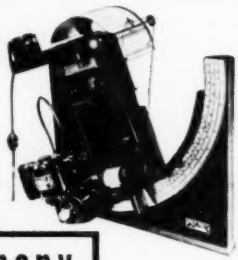

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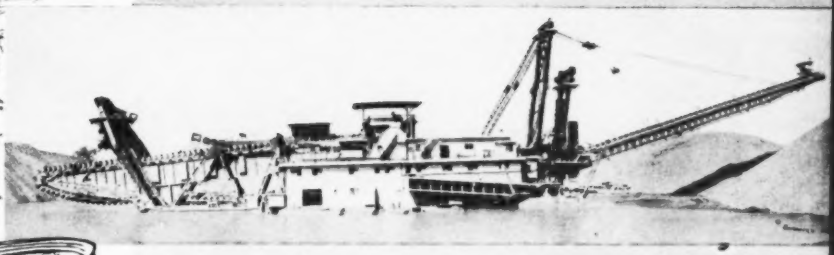

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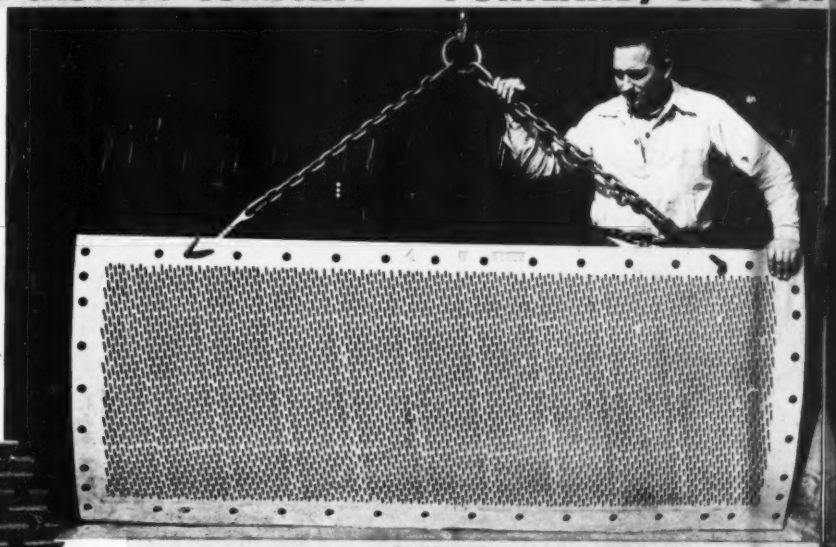

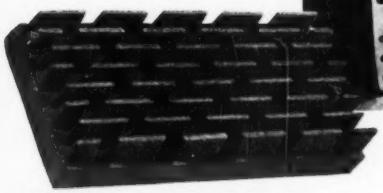

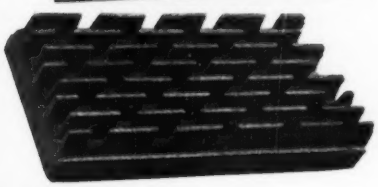

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